EXPORT ISSUE

Rubber and Plastics International Journal

VOL. 139 NO. 16 OCTOBER 15 1960 Price 1s. Weekly

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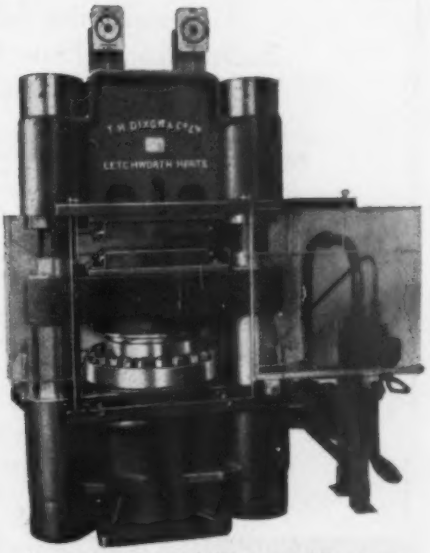
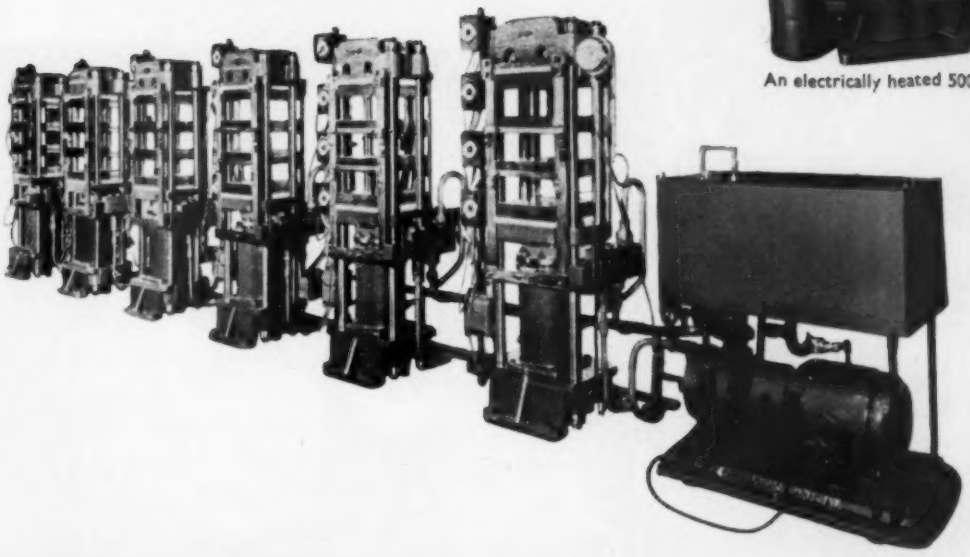


An electrically heated 500 ton moulding press.



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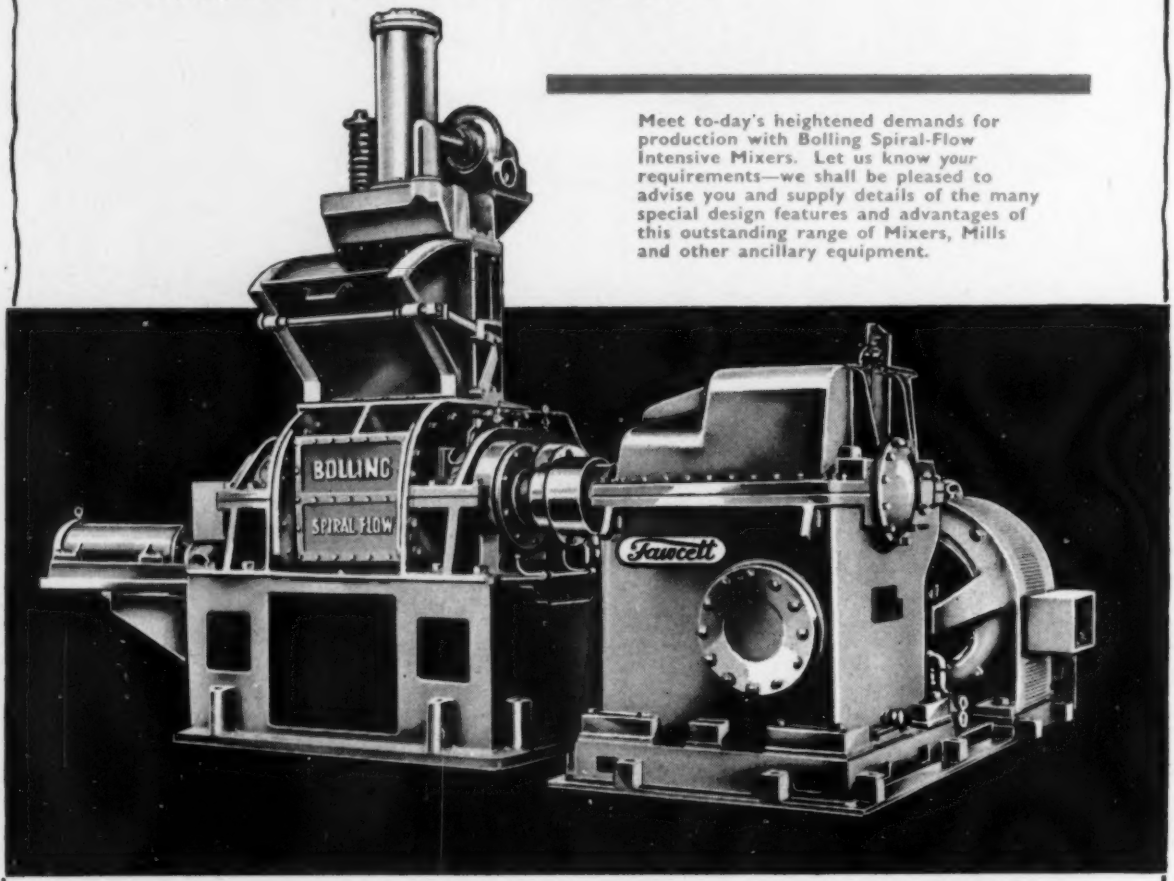

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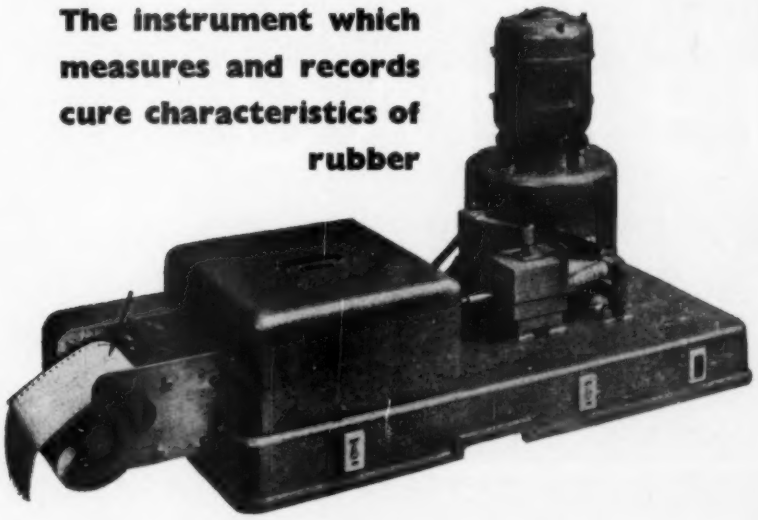

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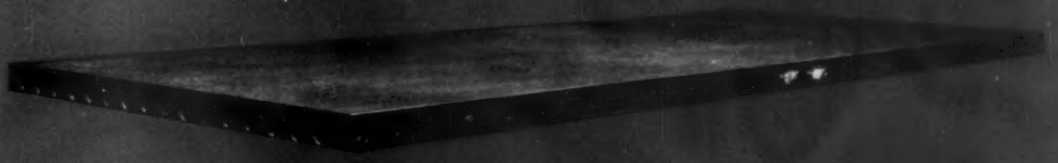

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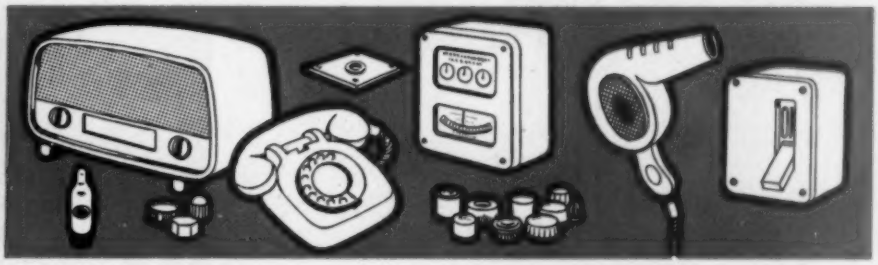

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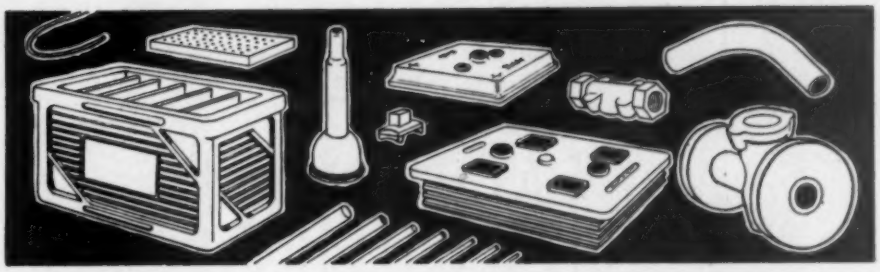

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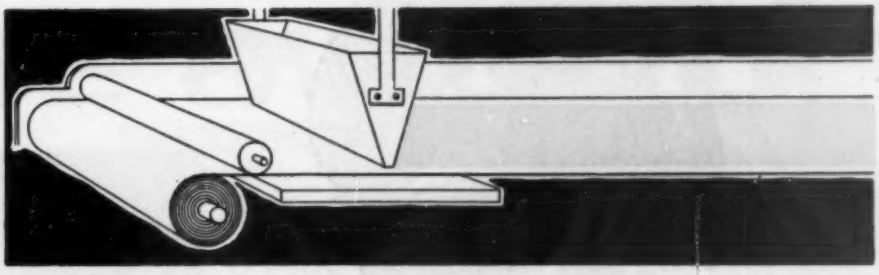

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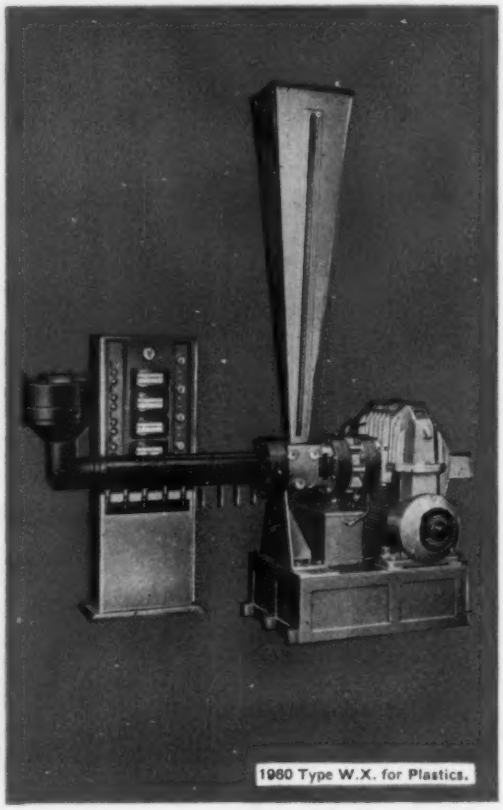

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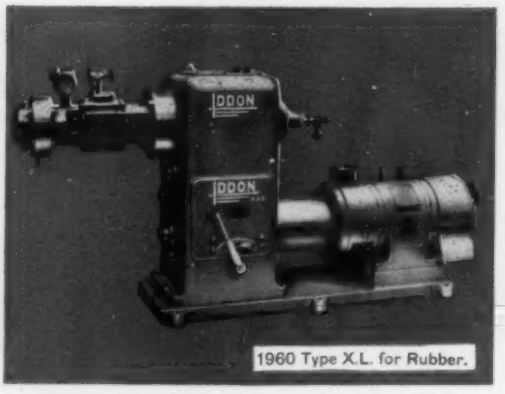

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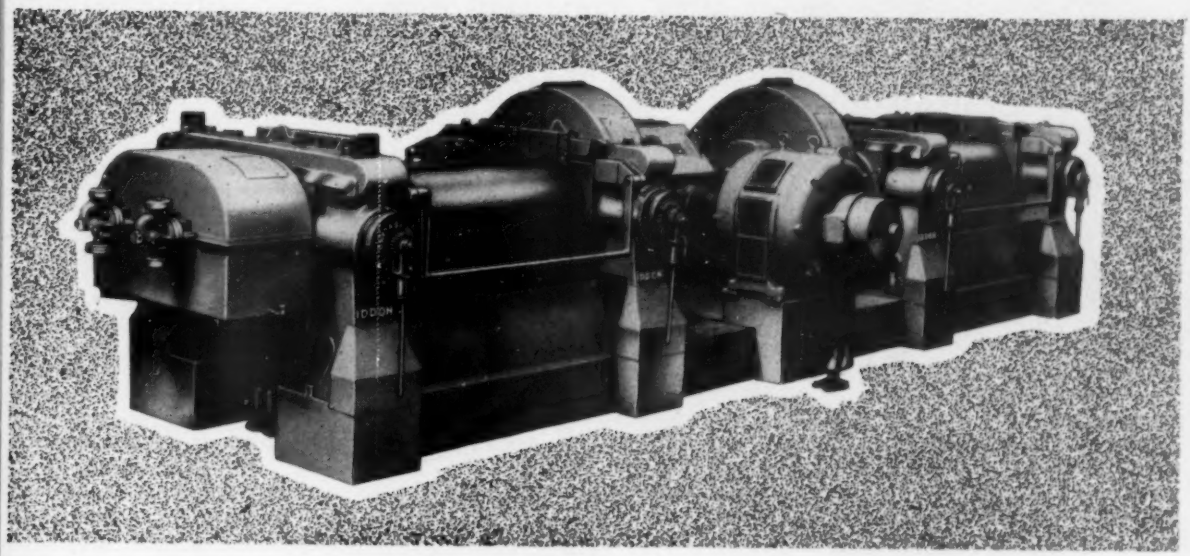

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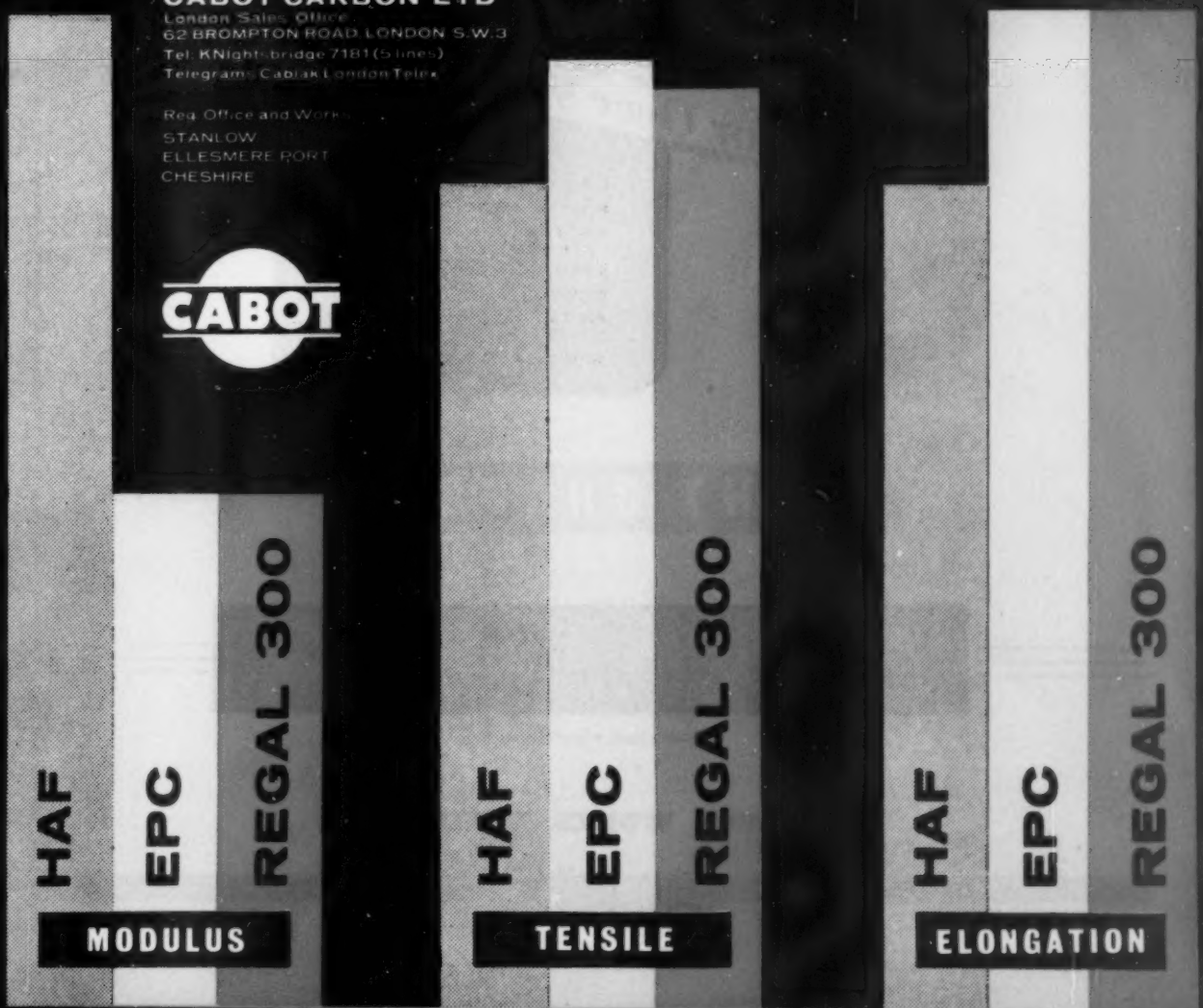

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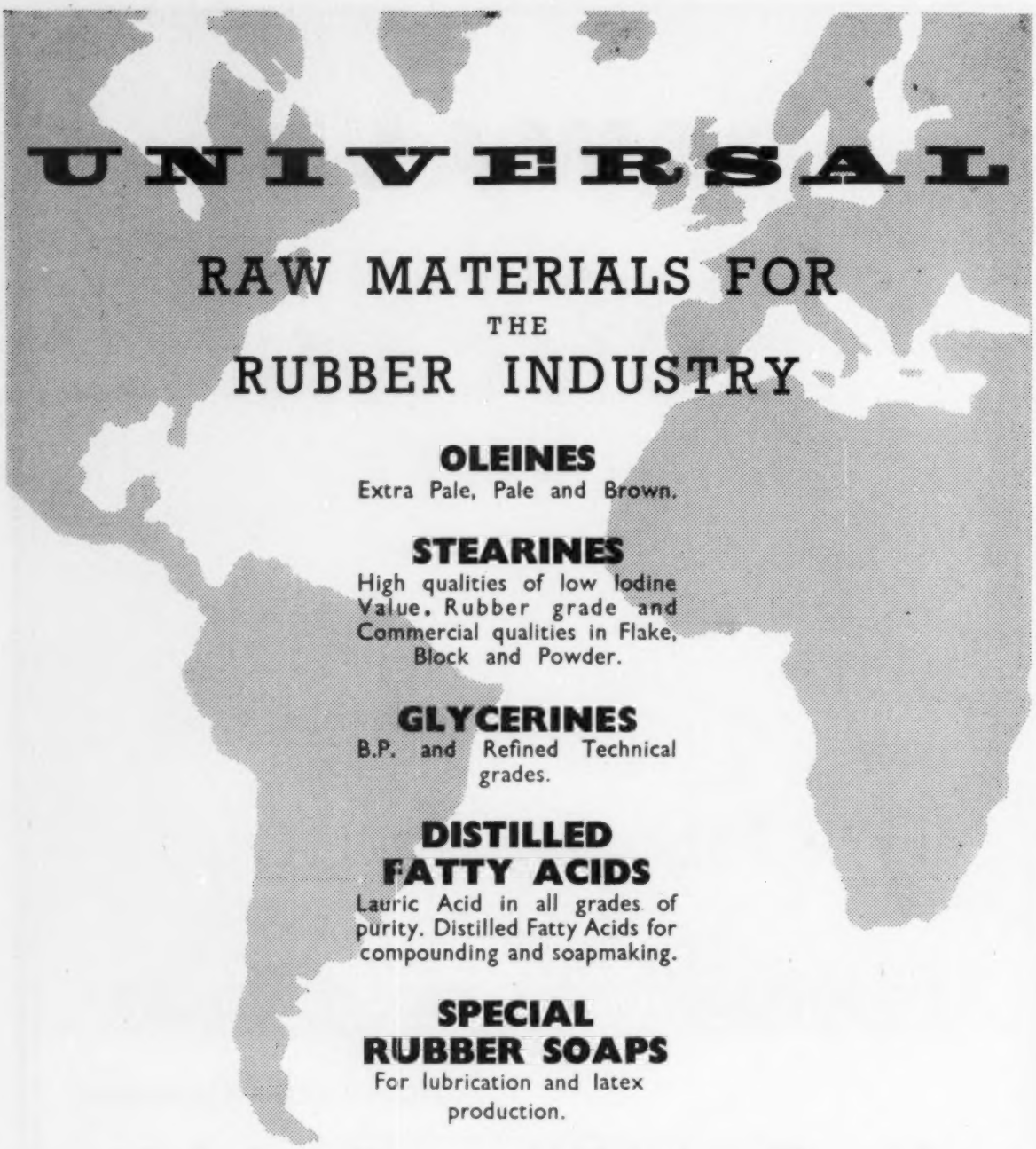

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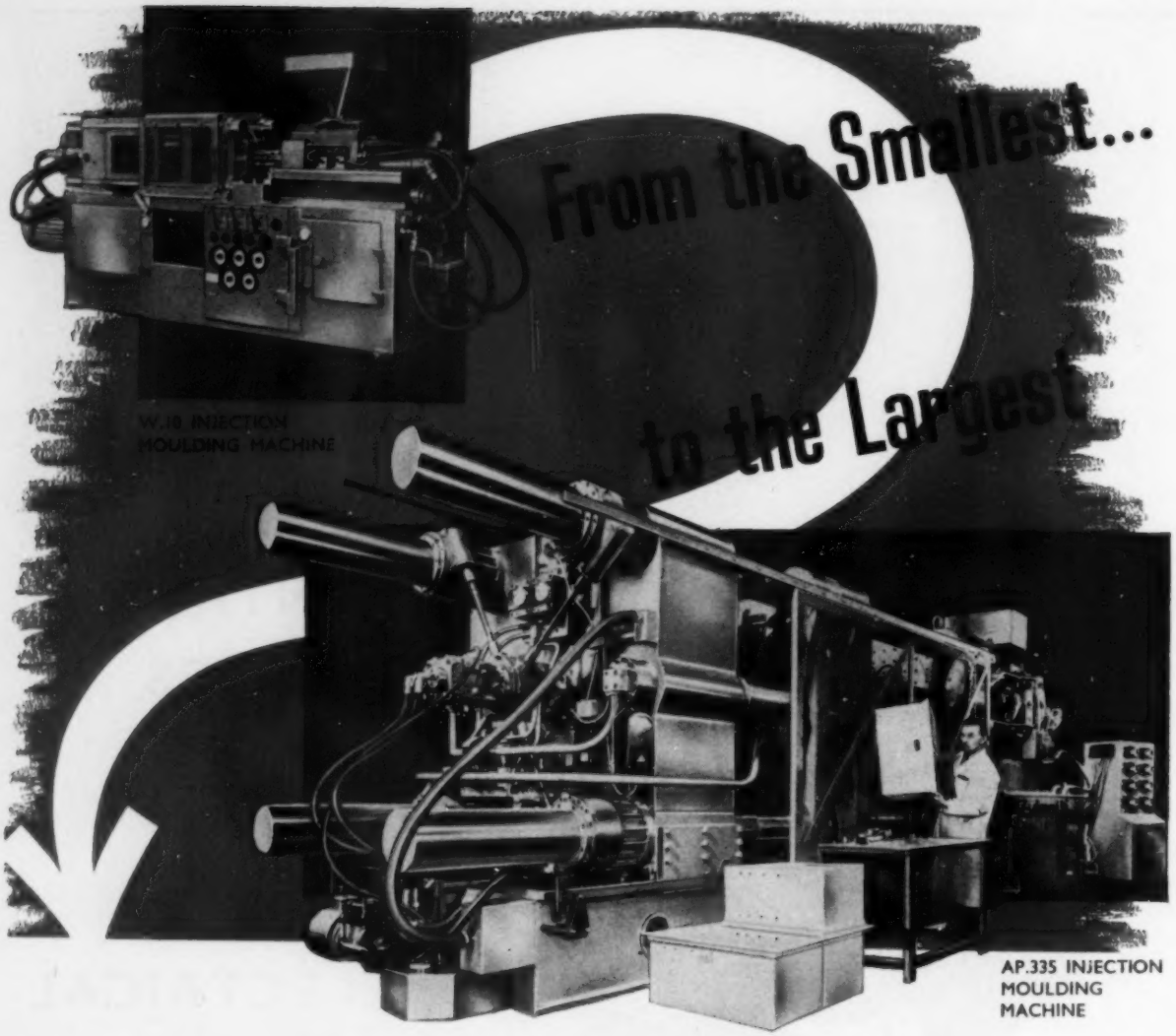

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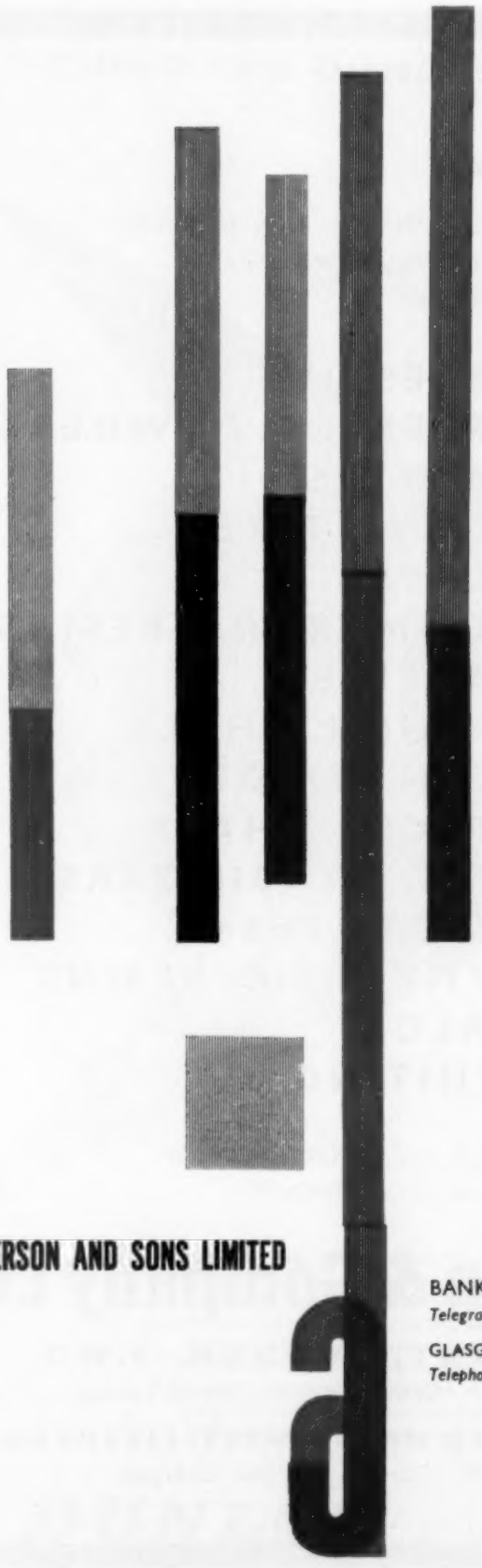

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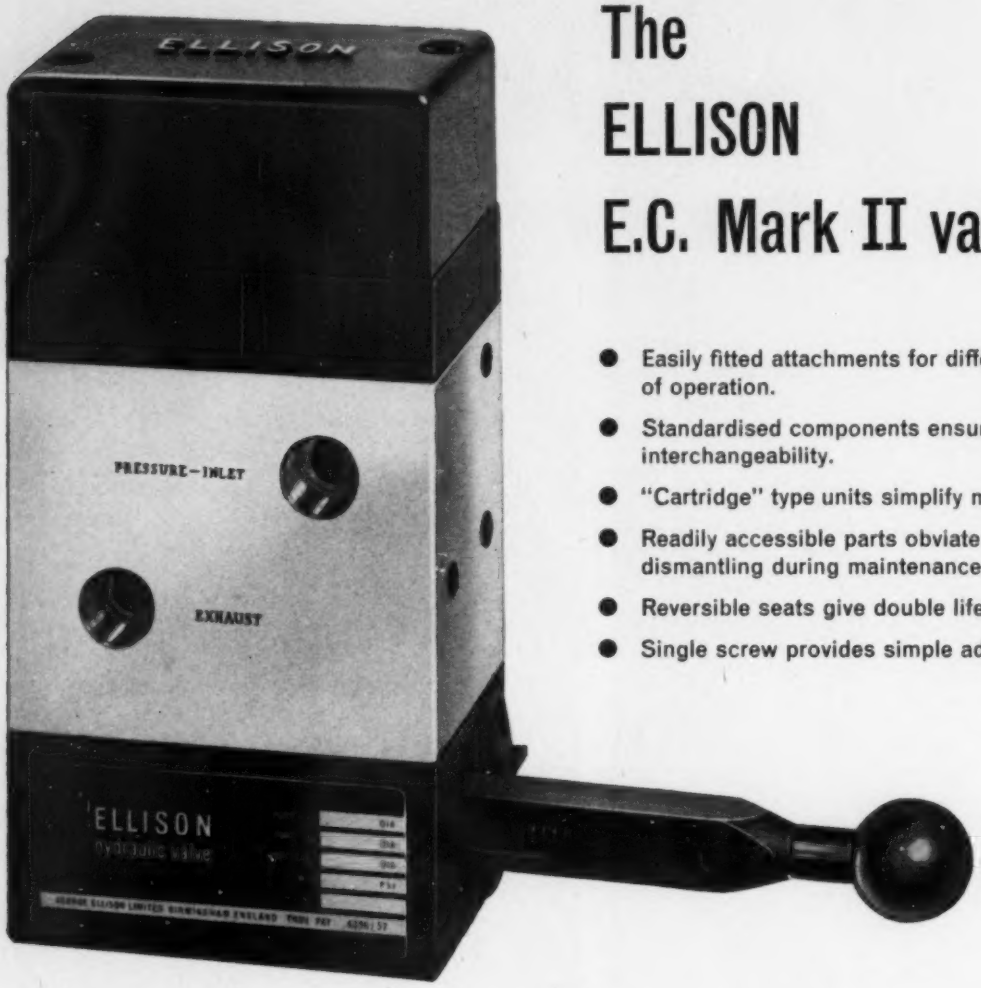

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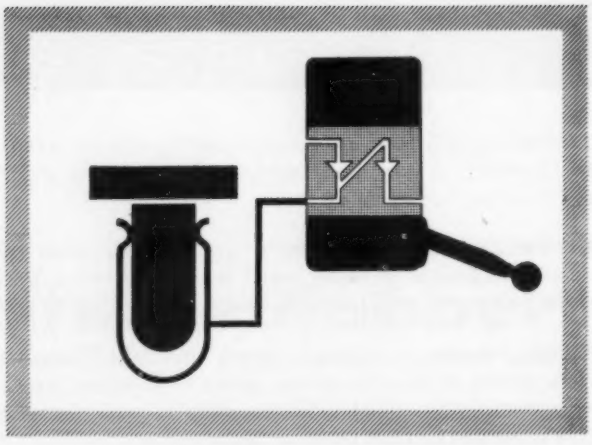

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102

Moving from the soap and water variety to Latex foam—Micafine Mica Powders have even more attractive qualities. For instance when Mica powder is added as a filler it hardens the foam rubber, thus enabling more air to be incorporated—which in turn results in a big saving in costs. Compared with other fillers Micafine Mica powders are remarkably easy to disperse—they can even be added dry to the latex foam mix. In every case whether Micafine powders are added dry or in a slurry an excellent foam structure is produced which can be used for articles varying from thin carpet backings, to thick sections such as cushions and mattresses. The unique laminar structure of Micafine powders maintains the desirable features of the foam including good mechanical and dynamic properties, regular cell structure and smooth skin. Mica powders are particularly useful in foam rubber made from synthetic Latex or blends of synthetic and natural Latex, as their ability to increase the hardness of the foam counteracts the softness of the foams containing synthetic Latex. For detailed information on the use of Mica powder as a filler write TODAY for a copy of 'Mica powder in Latex Foam Rubber'.

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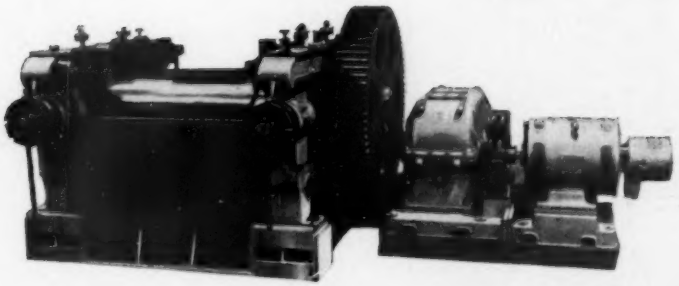

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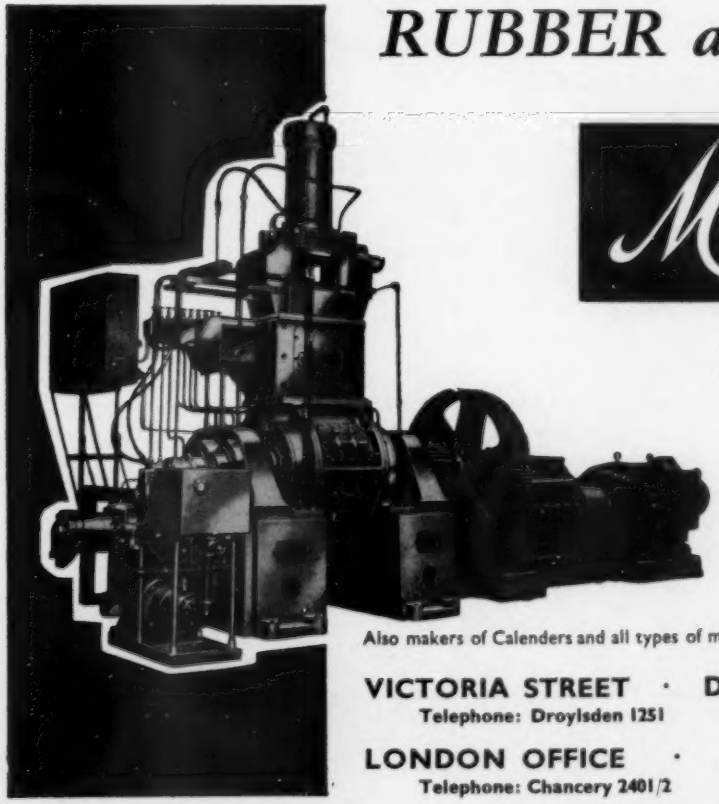

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for heat resistance

special "thin-flash" type for grille moulding

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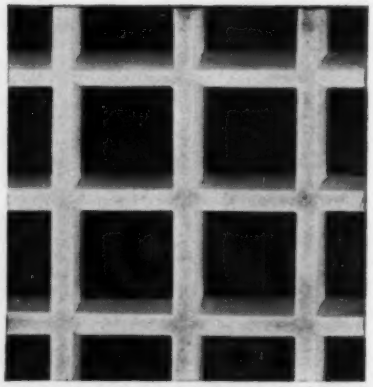
Beetle D.M.C. combines heat resistance with strength, dimensional stability and excellent insulation properties. The development of a special type for a single application typifies the extent of B.I.P. services in relation to individual problems and requirements.



Heat resistance, dimensional stability, strength and electrical insulation properties are among the features making D.M.C. the ideal material for this grille. Moulding by Crystalate (Mouldings) Ltd, Tonbridge, Kent.

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Polyester **d**ough **m**oulding **C**ompound

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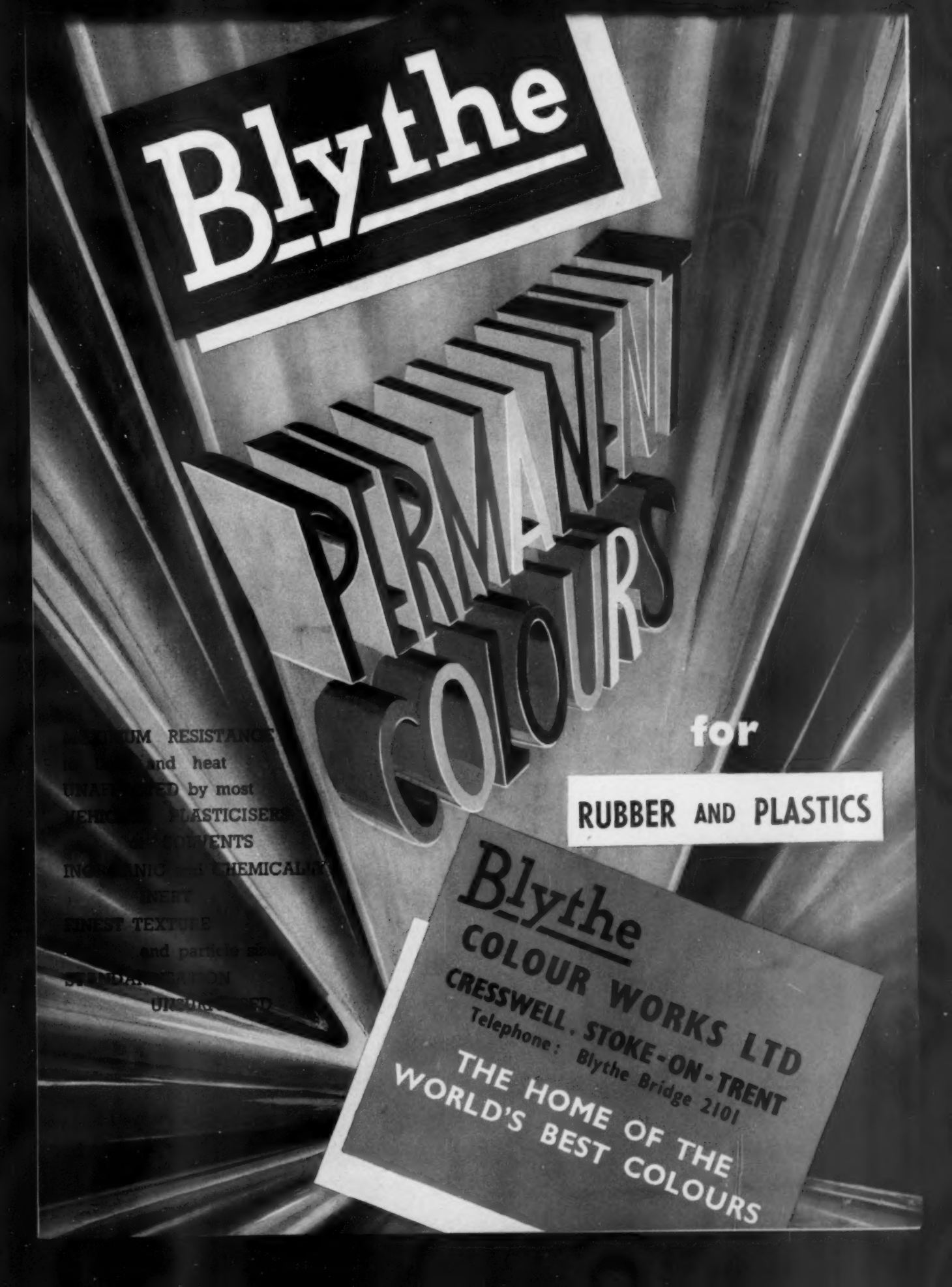
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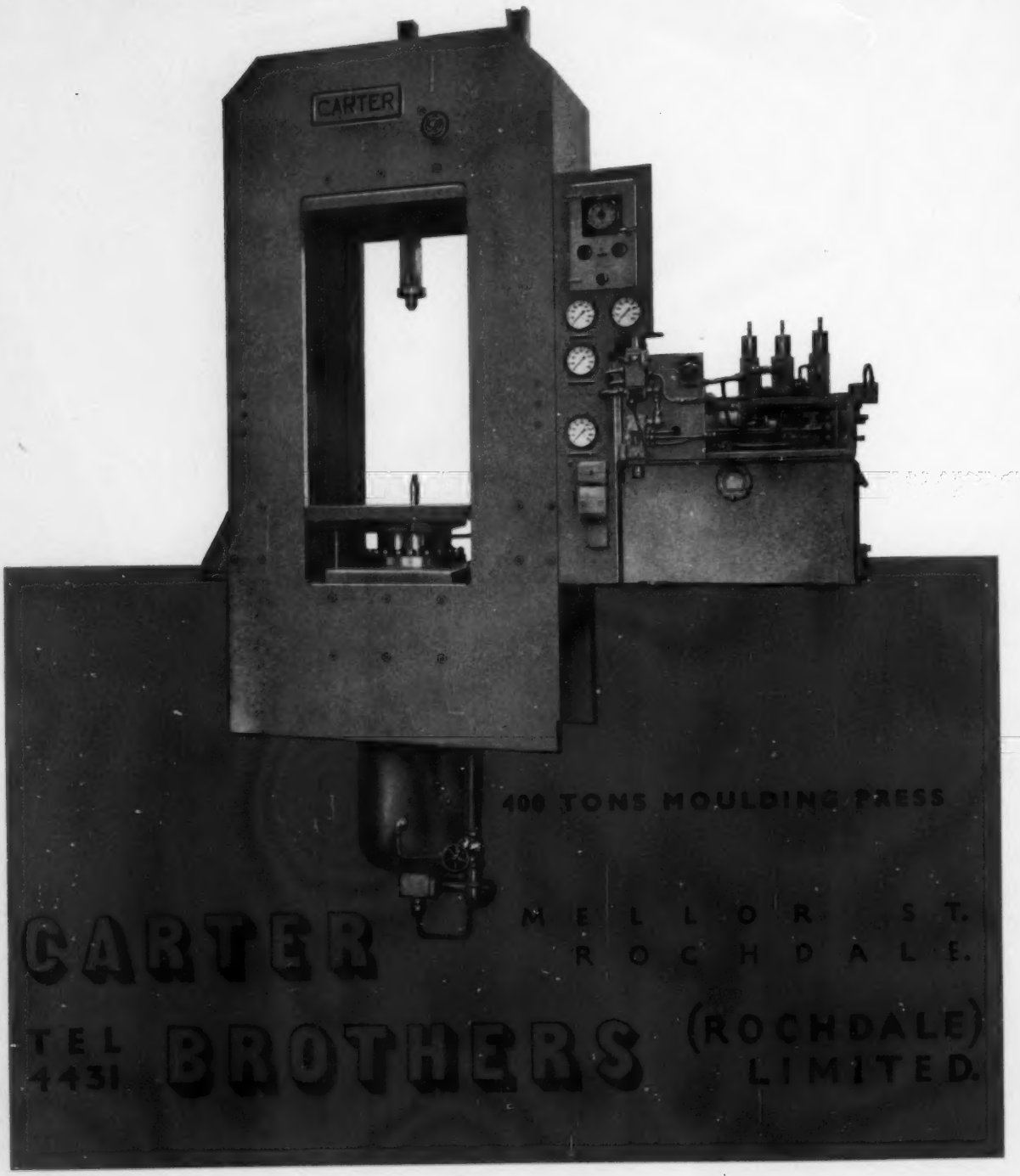

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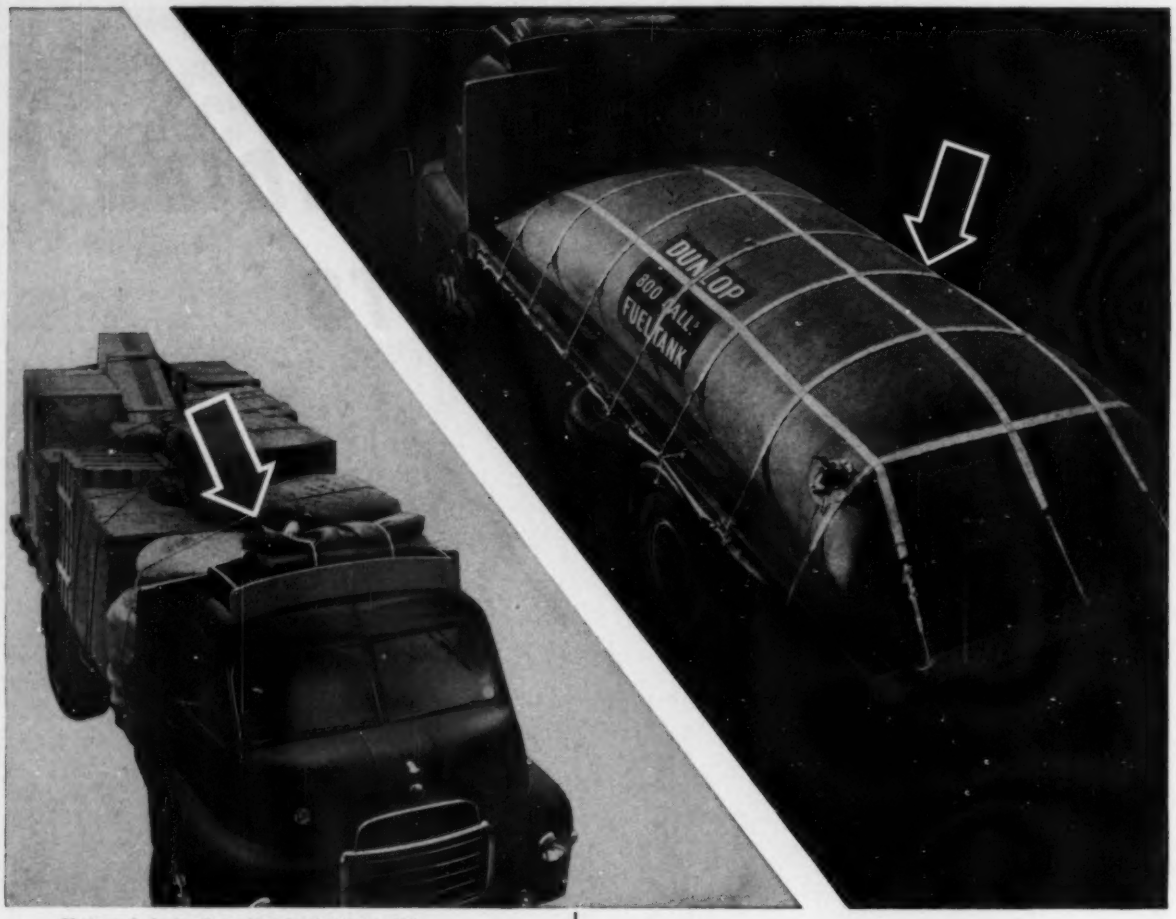

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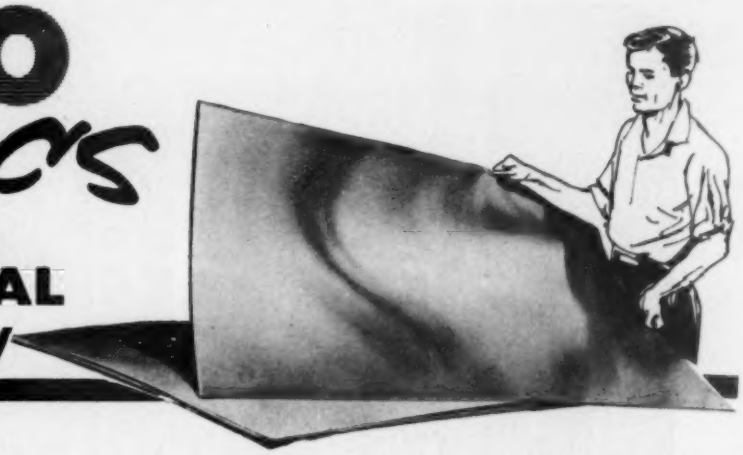

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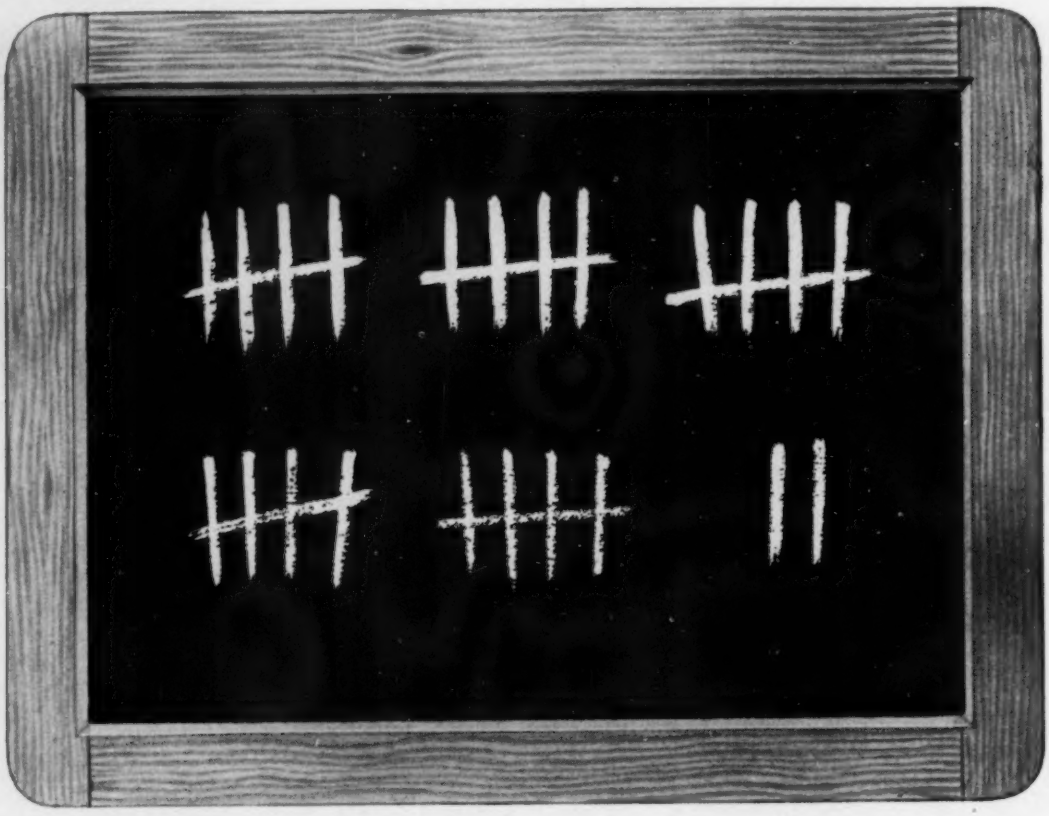

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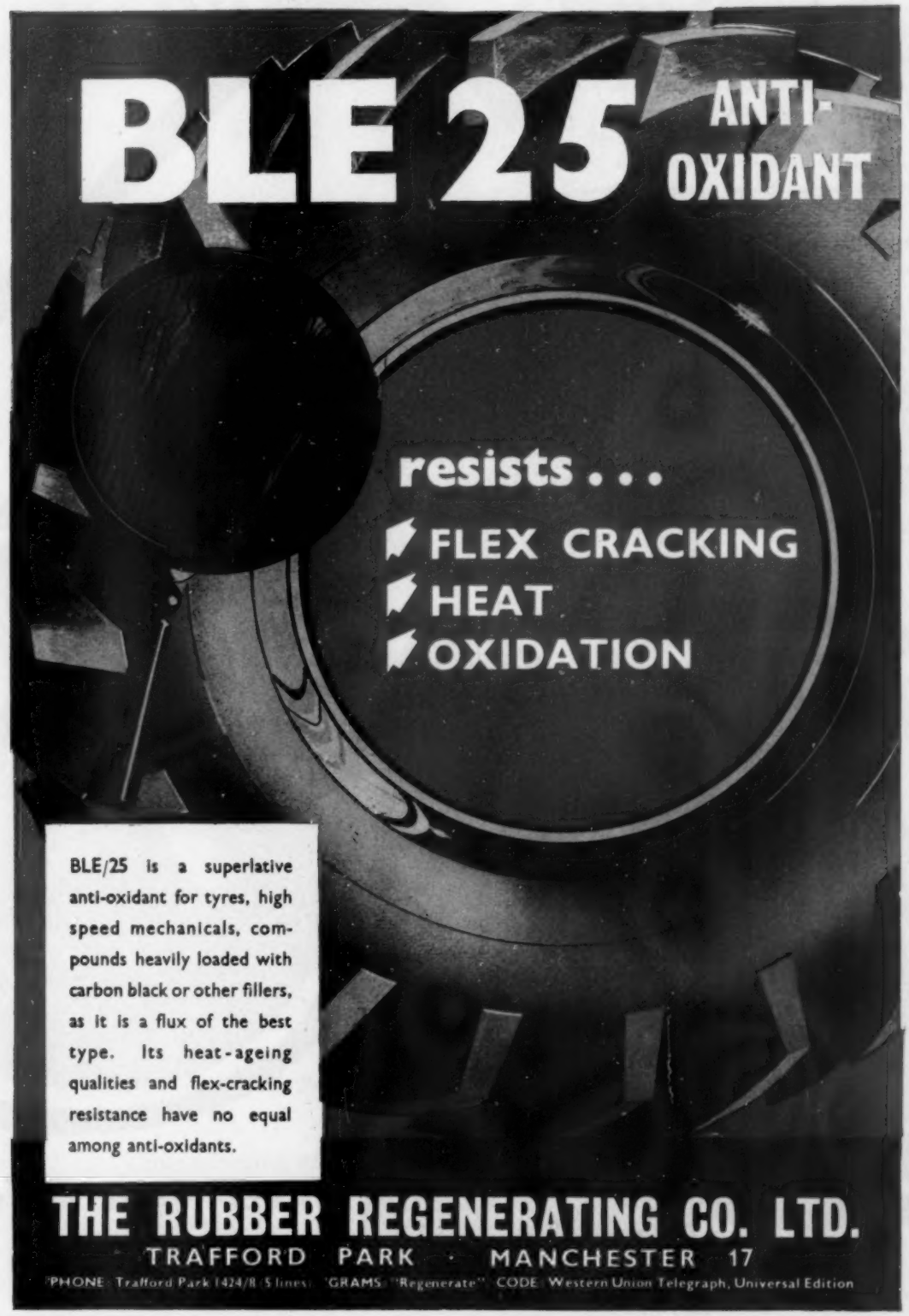
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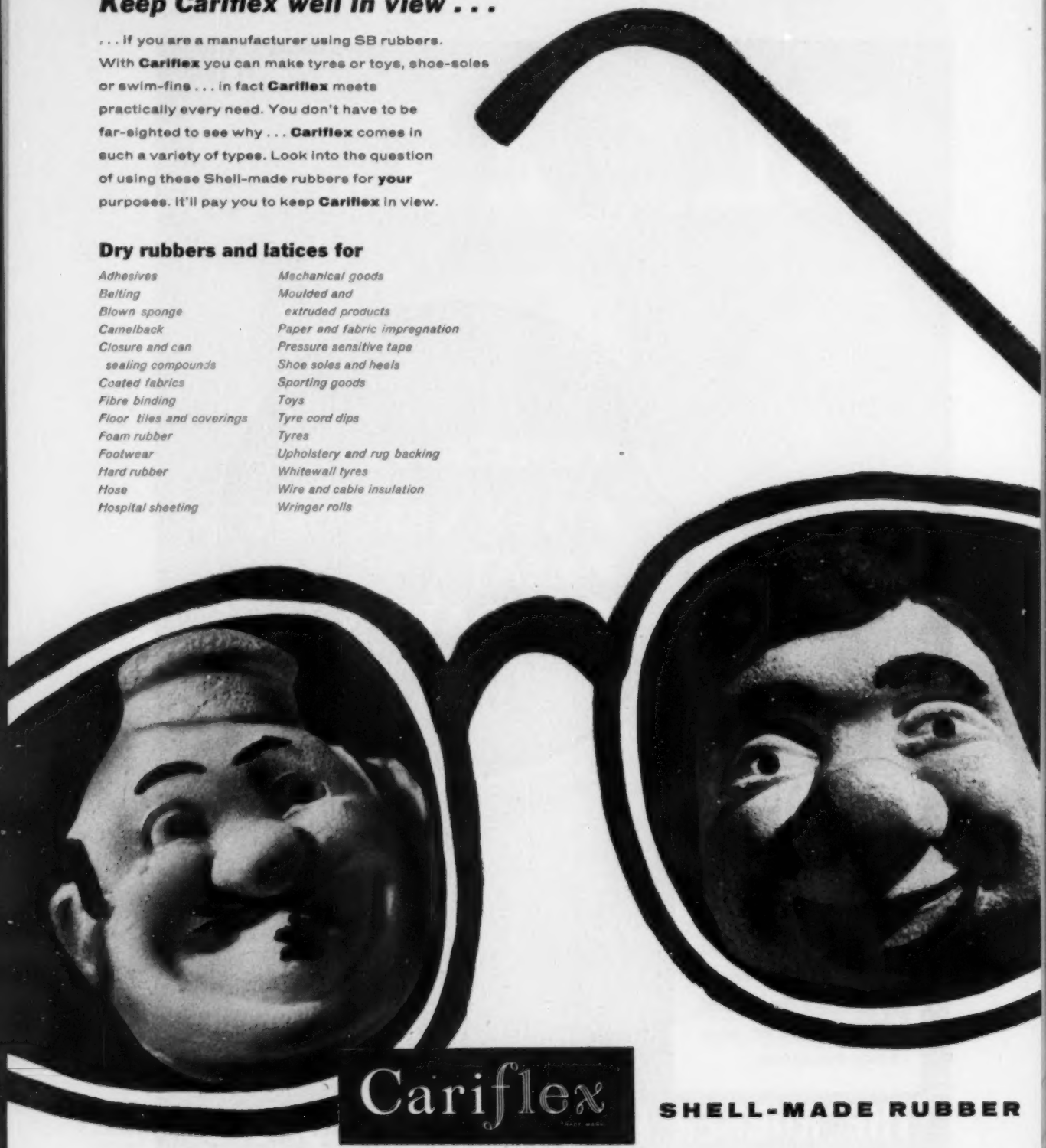

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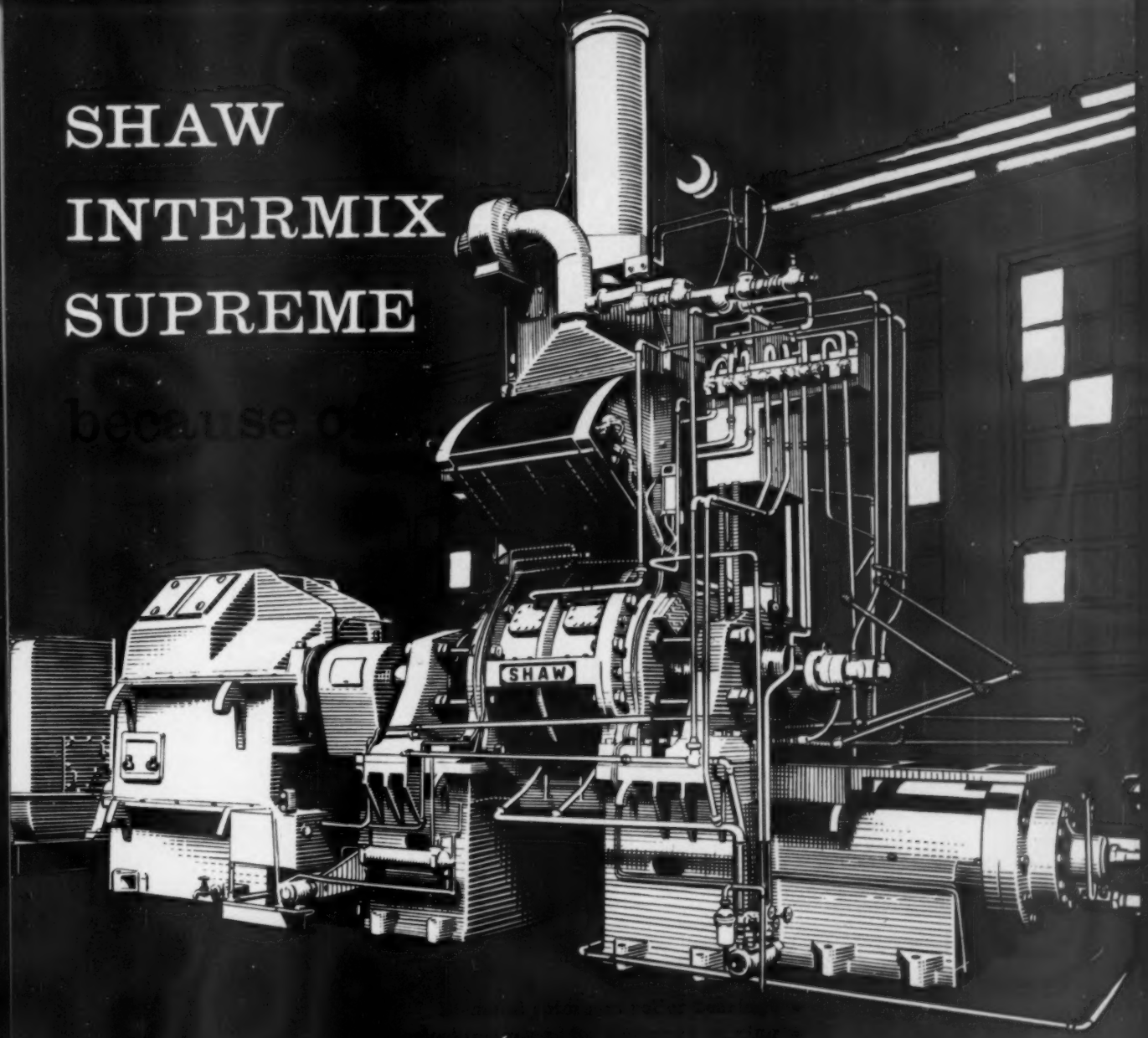

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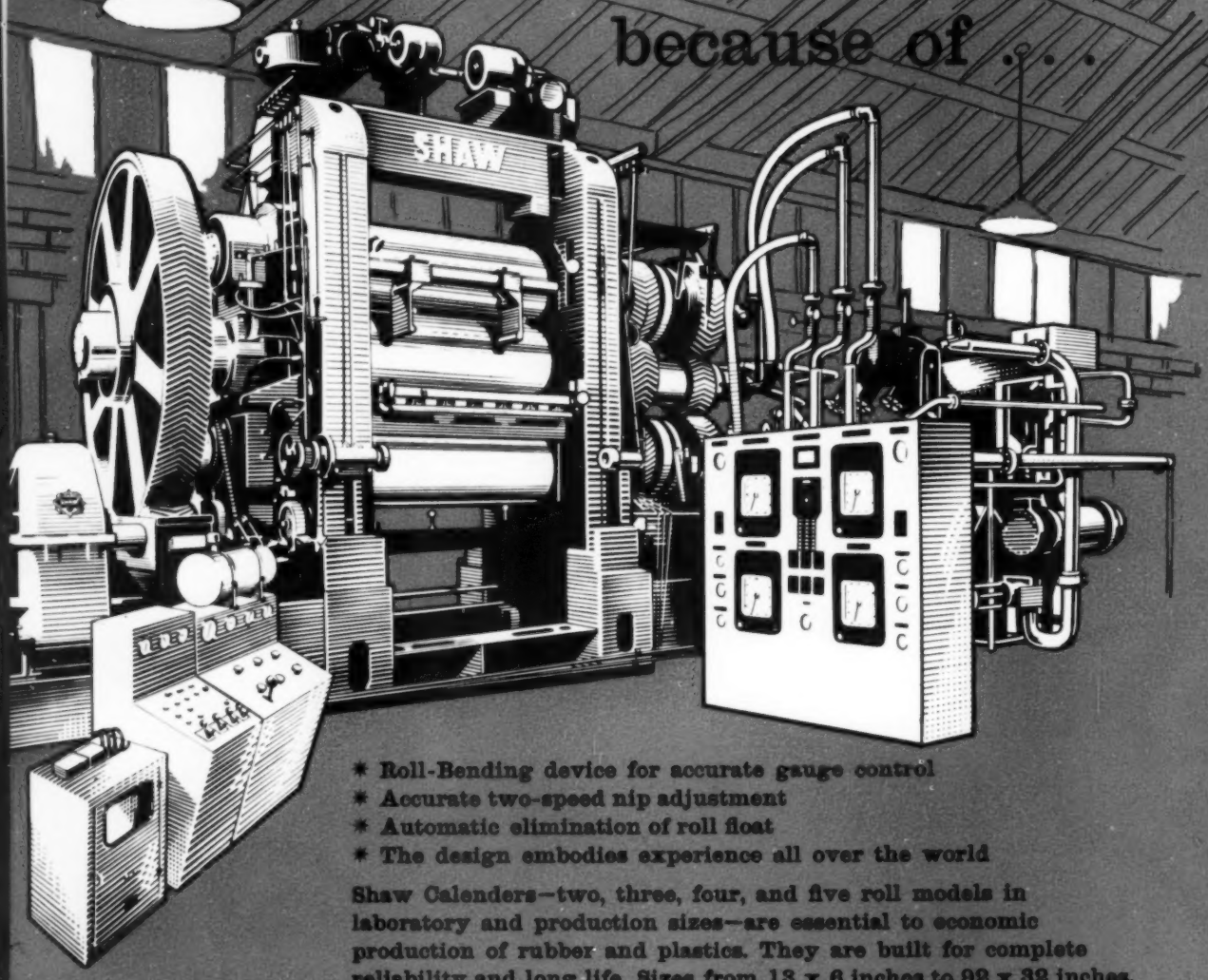

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Shaw Calenders—two, three, four, and five roll models in laboratory and production sizes—are essential to economic production of rubber and plastics. They are built for complete reliability and long life. Sizes from 13 x 6 inches to 92 x 32 inches.

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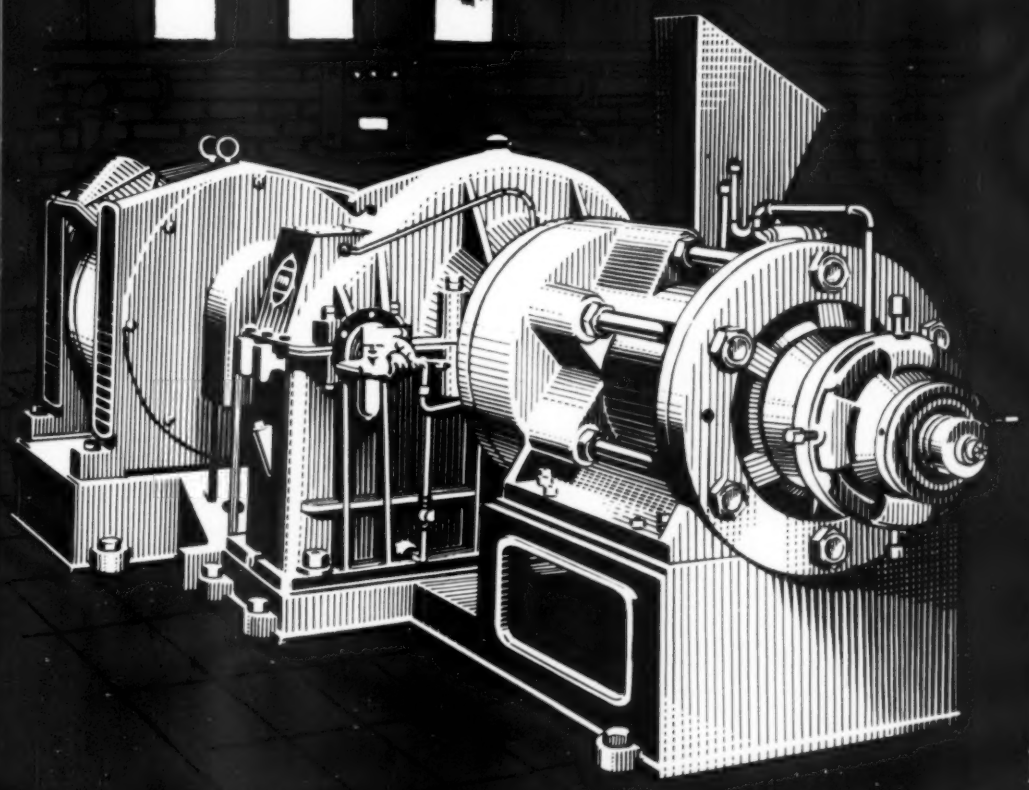
P.5960

SHAW
RUBBER EXTRUDERS
SUPREME



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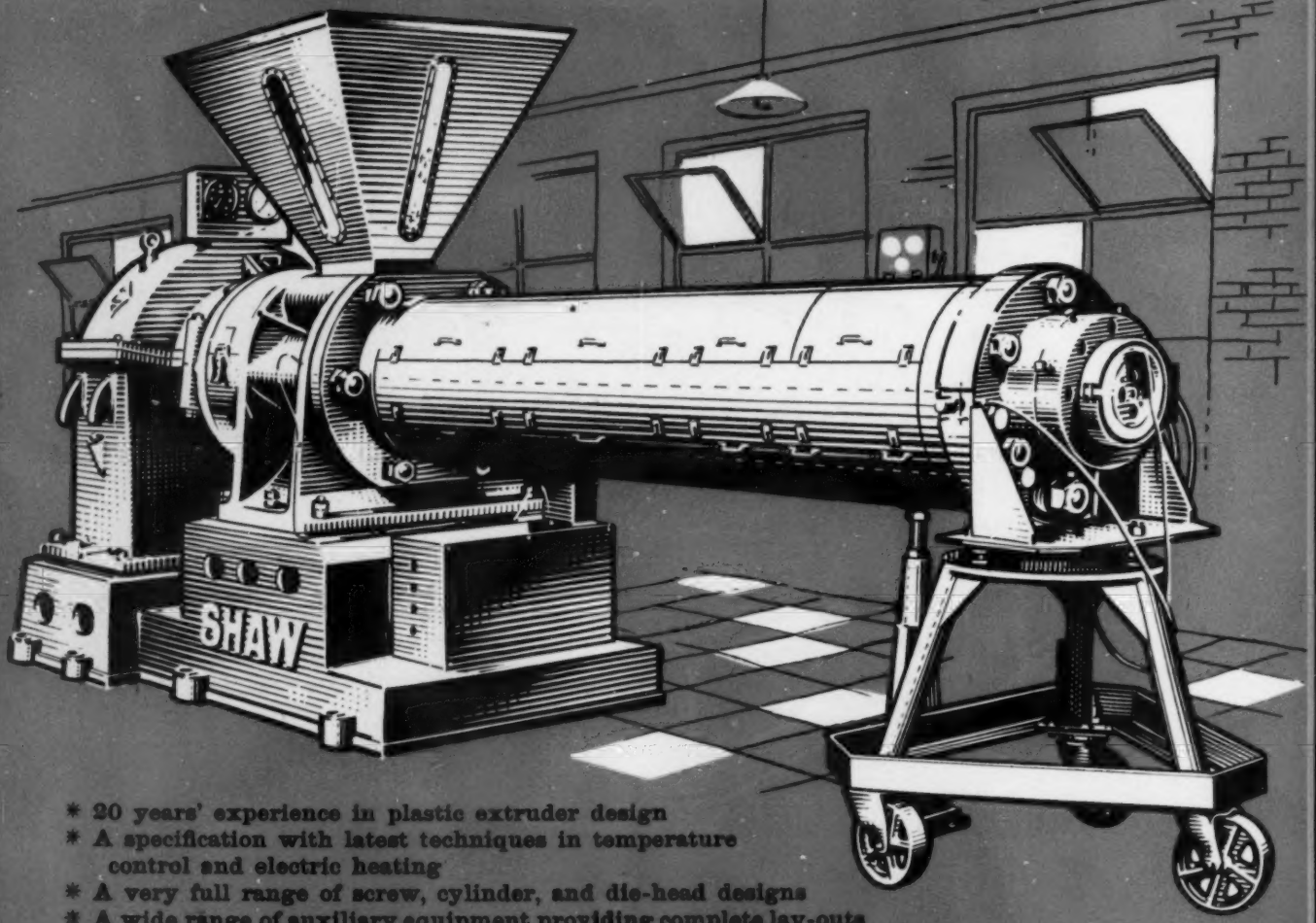

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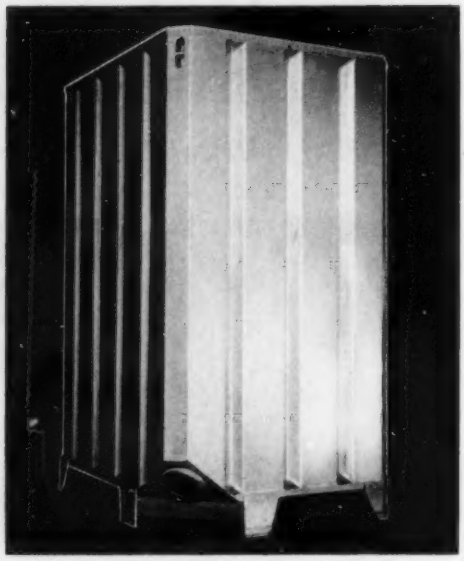
Rationalisation in Carbon Black transport

KETJEN CARBON

invented the

TILT-O-CON



a new type of container, which is tilted for complete filling and emptying. Besides easy handling and unloading, the Tilt-O-Con offers these big advantages to consumers of Ketjenblacks:

ECONOMICAL PACKING This sturdy light-weight aluminium container holds one ton of carbon black and can be used over and over again. Just ship it back for filling with any of the seven types of Ketjenblack you require. Its design is such that during transport the Tilt-O-Con takes up a minimum amount of space.

NO WAREHOUSE SPACE The Tilt-O-Con may be stored in the open air indefinitely. So valuable warehouse space may be used for less durable materials. The corrosionproof material and the air-tight closures protect the contents against contamination. The container can be stacked three high, thus taking up a minimum of floor space, whether indoors or outdoors.

NO DUST, NO SPILLING The special design of the openings and closures of the Tilt-O-Con and of the fool-proof unloading system prevent carbon black from being spilt and avoid dust formation.

SAVING LABOUR COST With the Tilt-O-Con one man can unload one ton of carbon black in less time than traditionally.

Blacks from the country where the black tulip grows

Available on request: *A brochure describing in detail the Tilt-O-Con as well as various suggested unloading systems for large and small consumers of*

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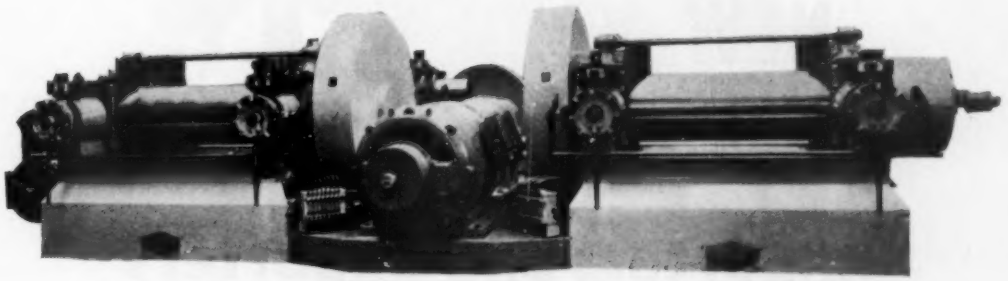

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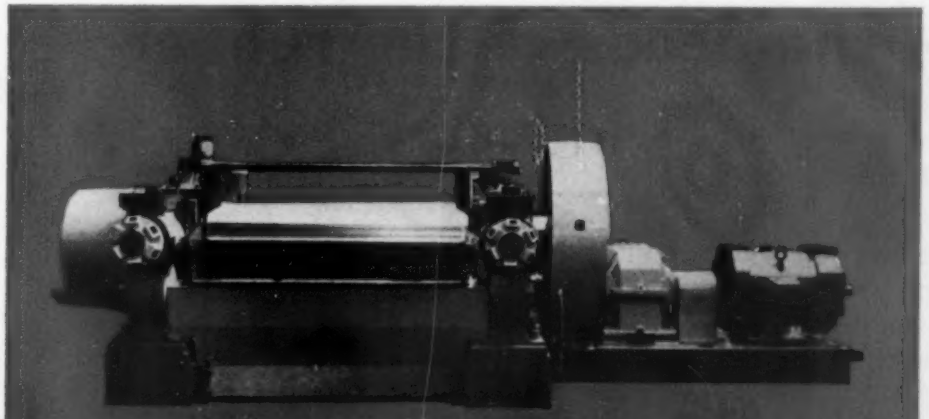

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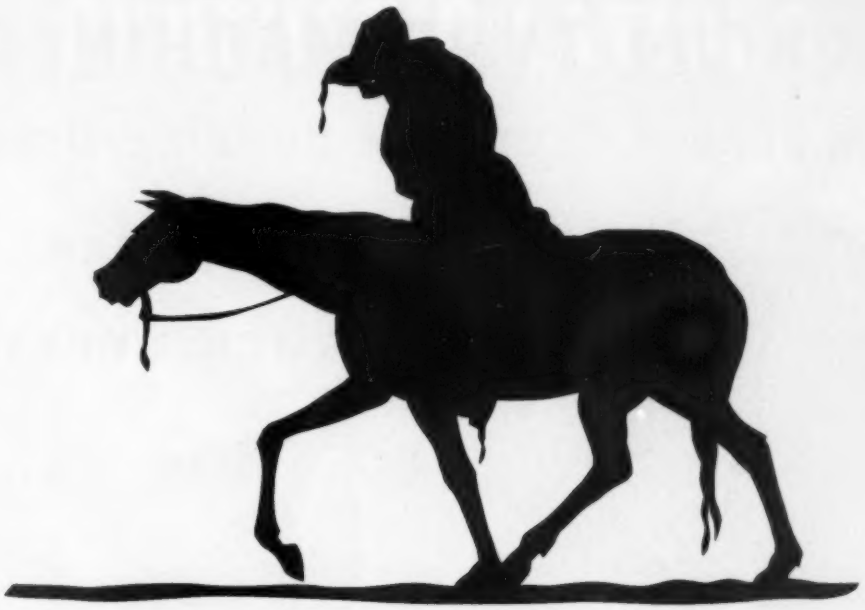

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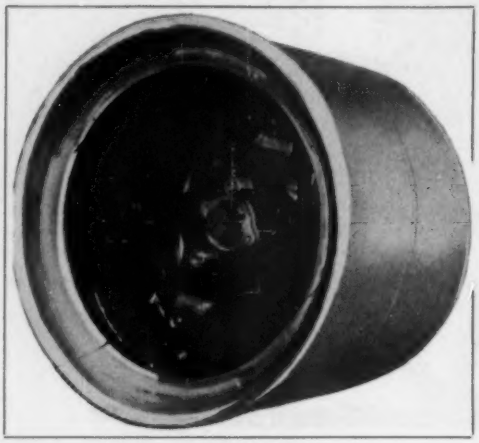

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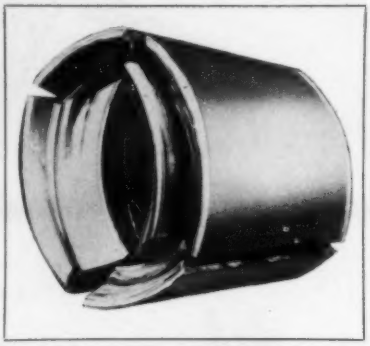

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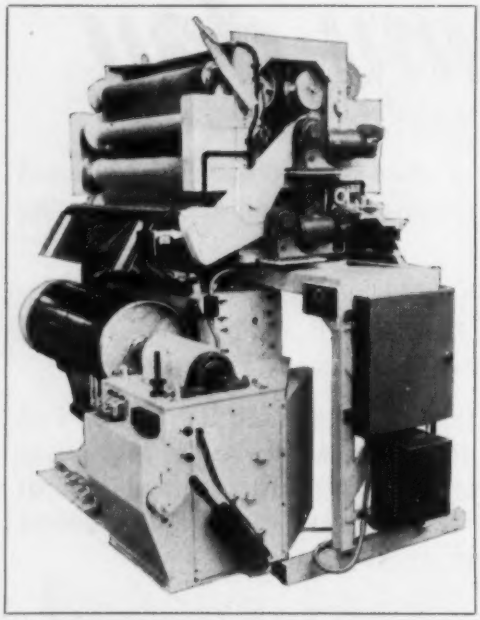

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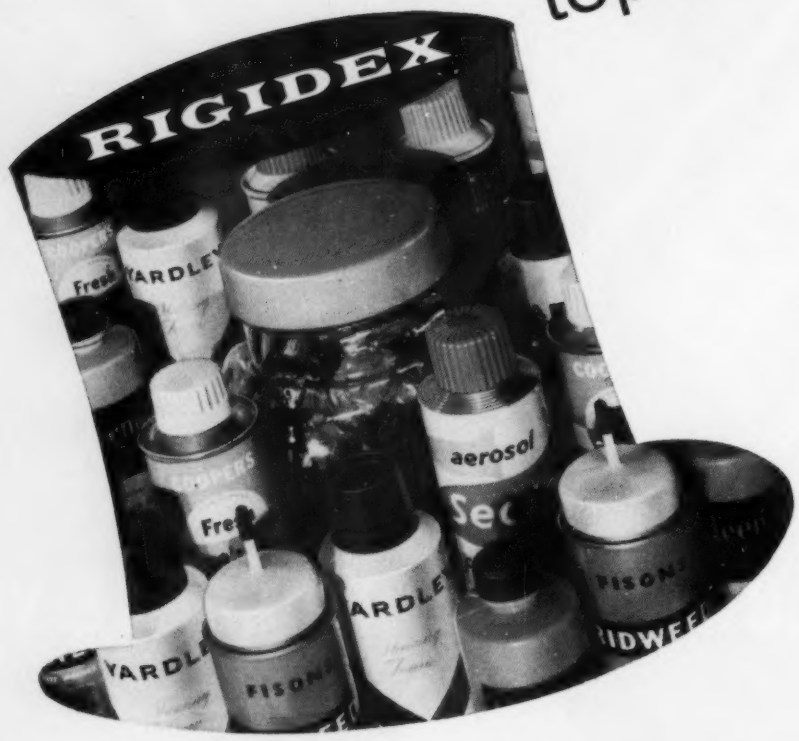

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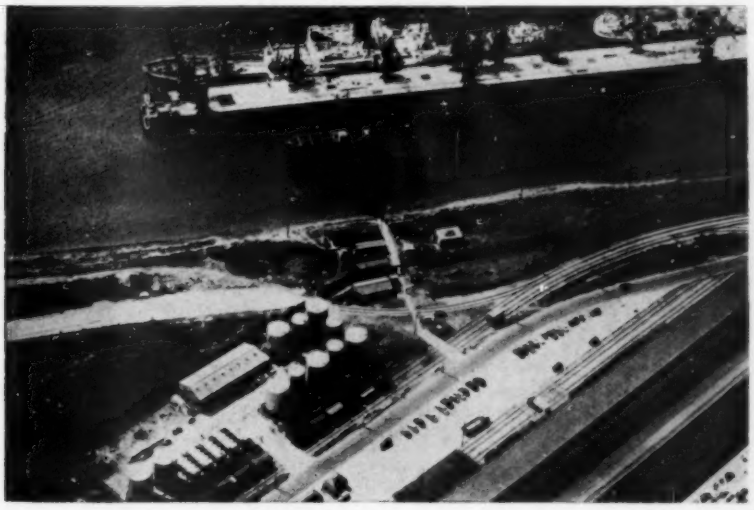

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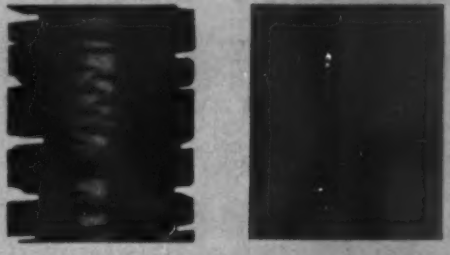
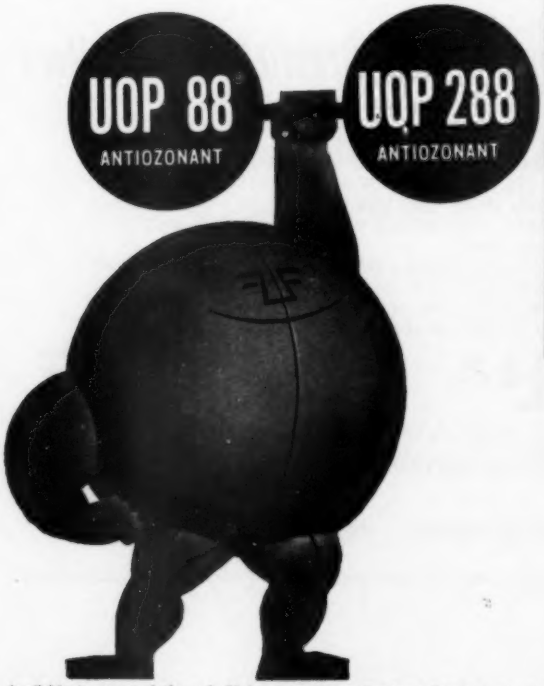


Carbon black—HAF (high abrasion furnace). Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace). Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.



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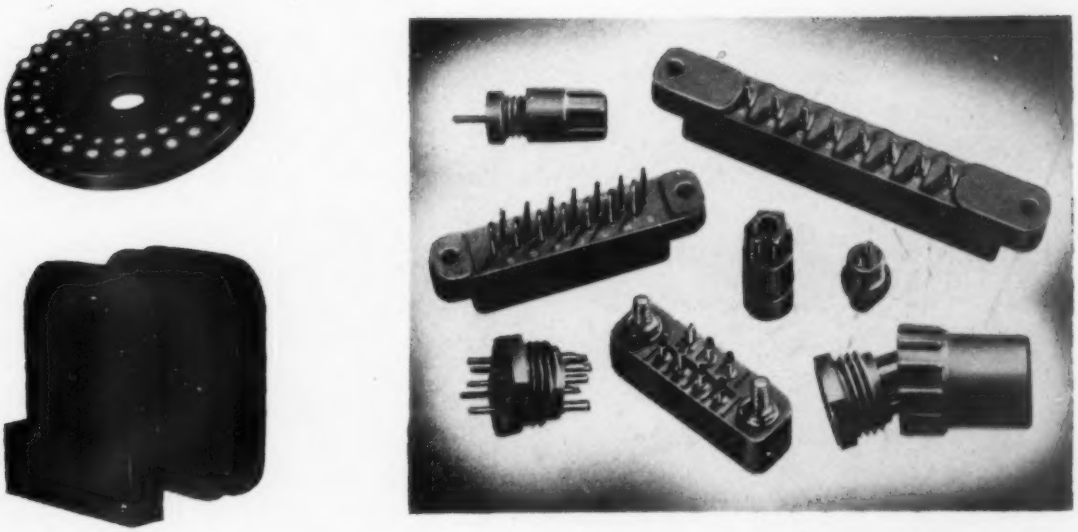

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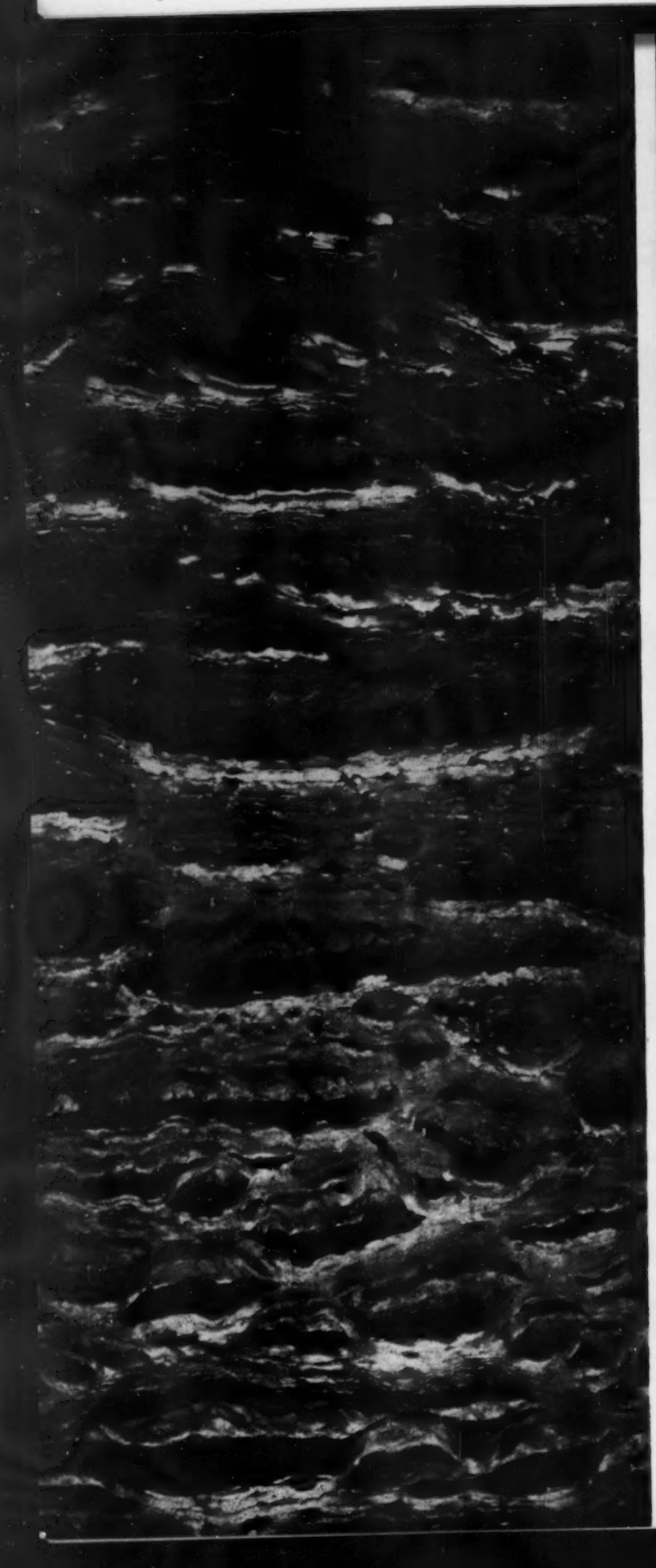

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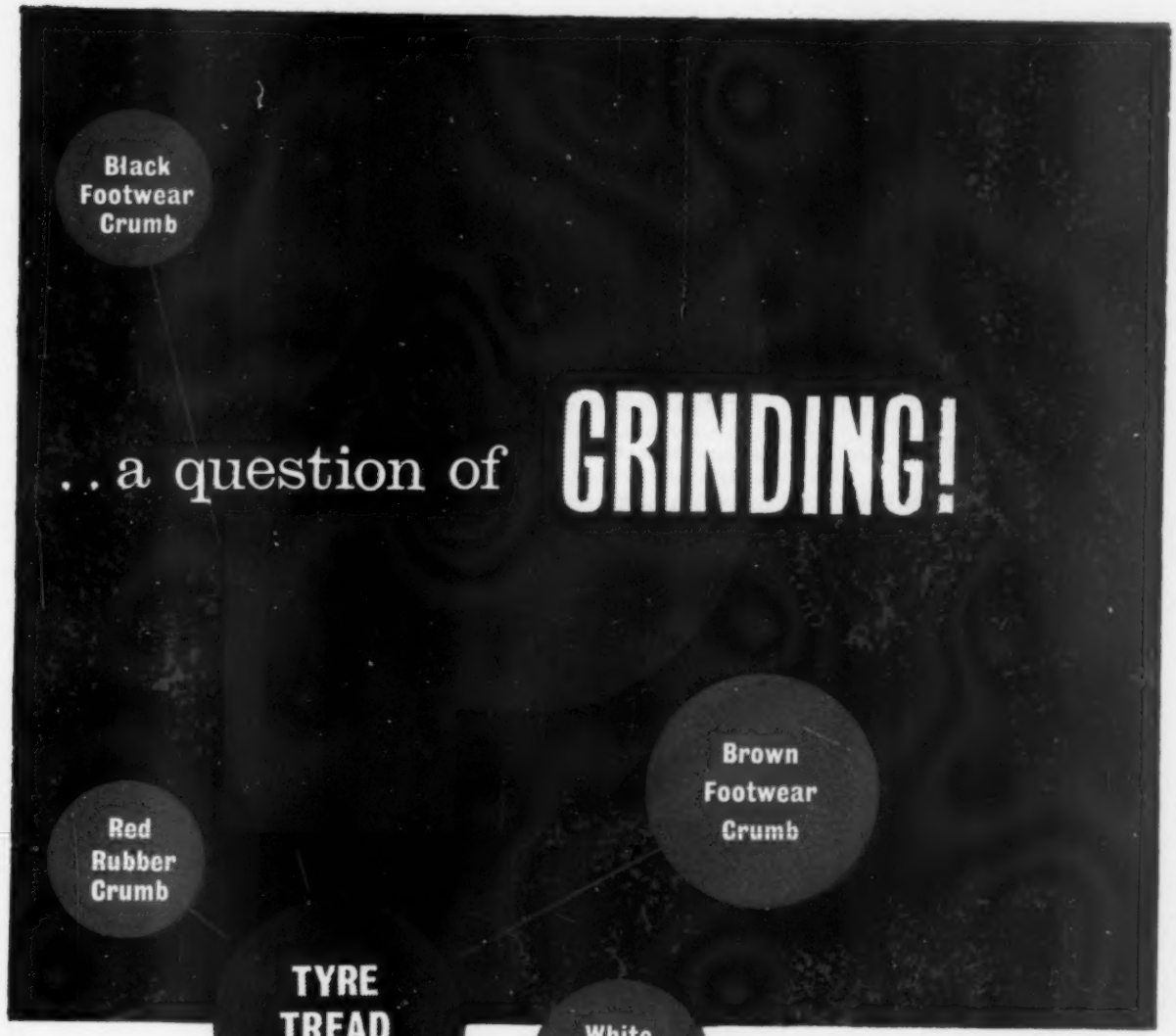

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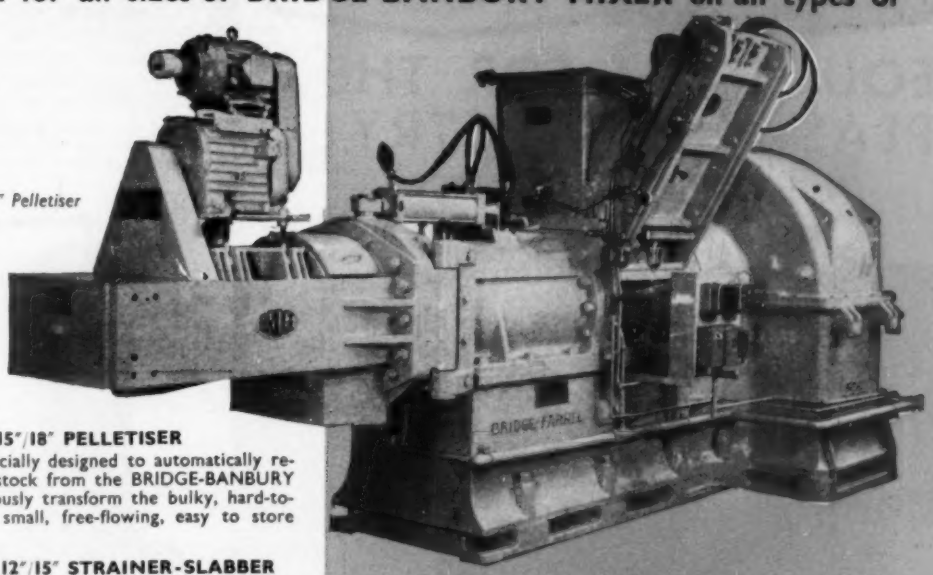

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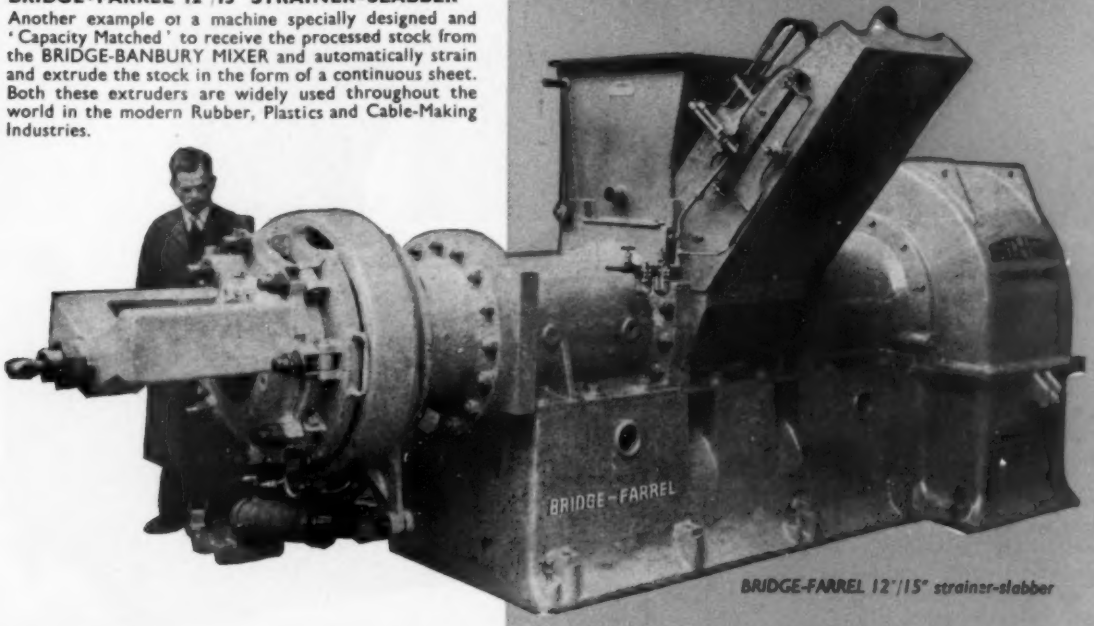

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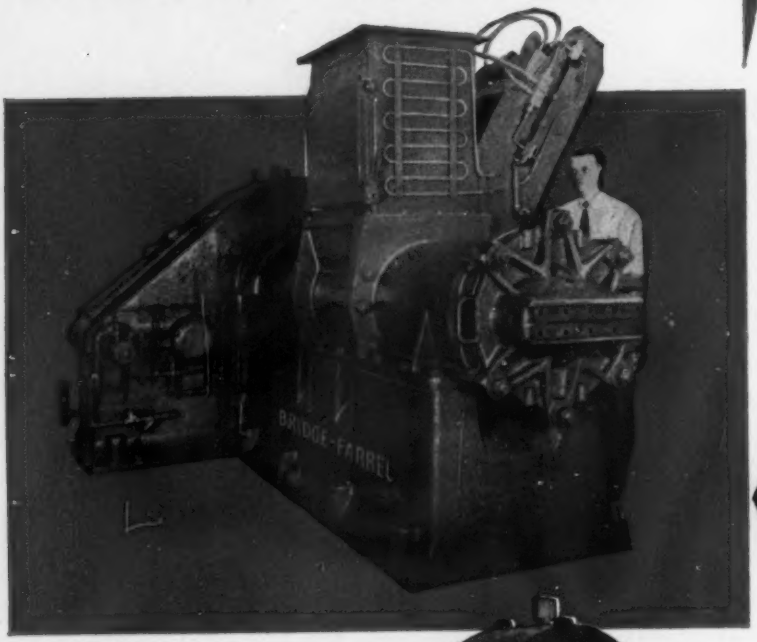

(Illustrated above)

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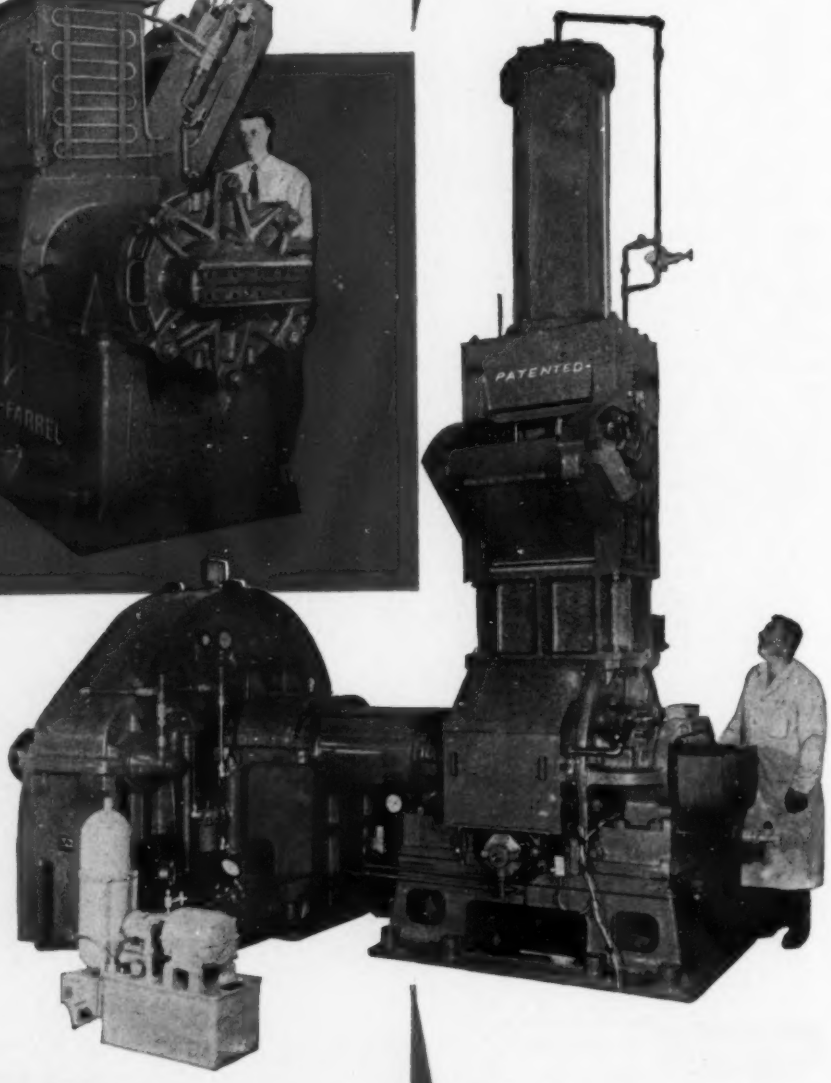

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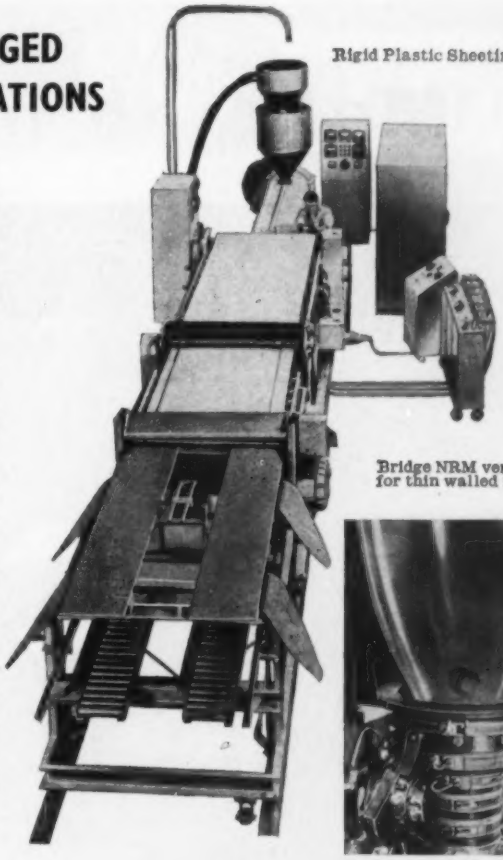

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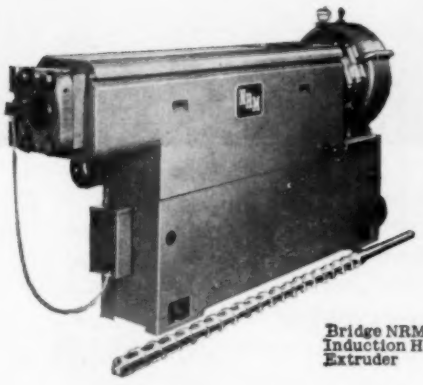

Bridge NRM 3½" Model 55 Induction Heated Plastic Extruder

Bridge NRM 2½" Model 50 electrically heated Plastic Extruder

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IN ITS 77th YEAR

October 15 1960

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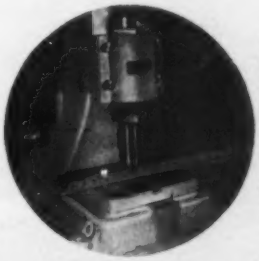

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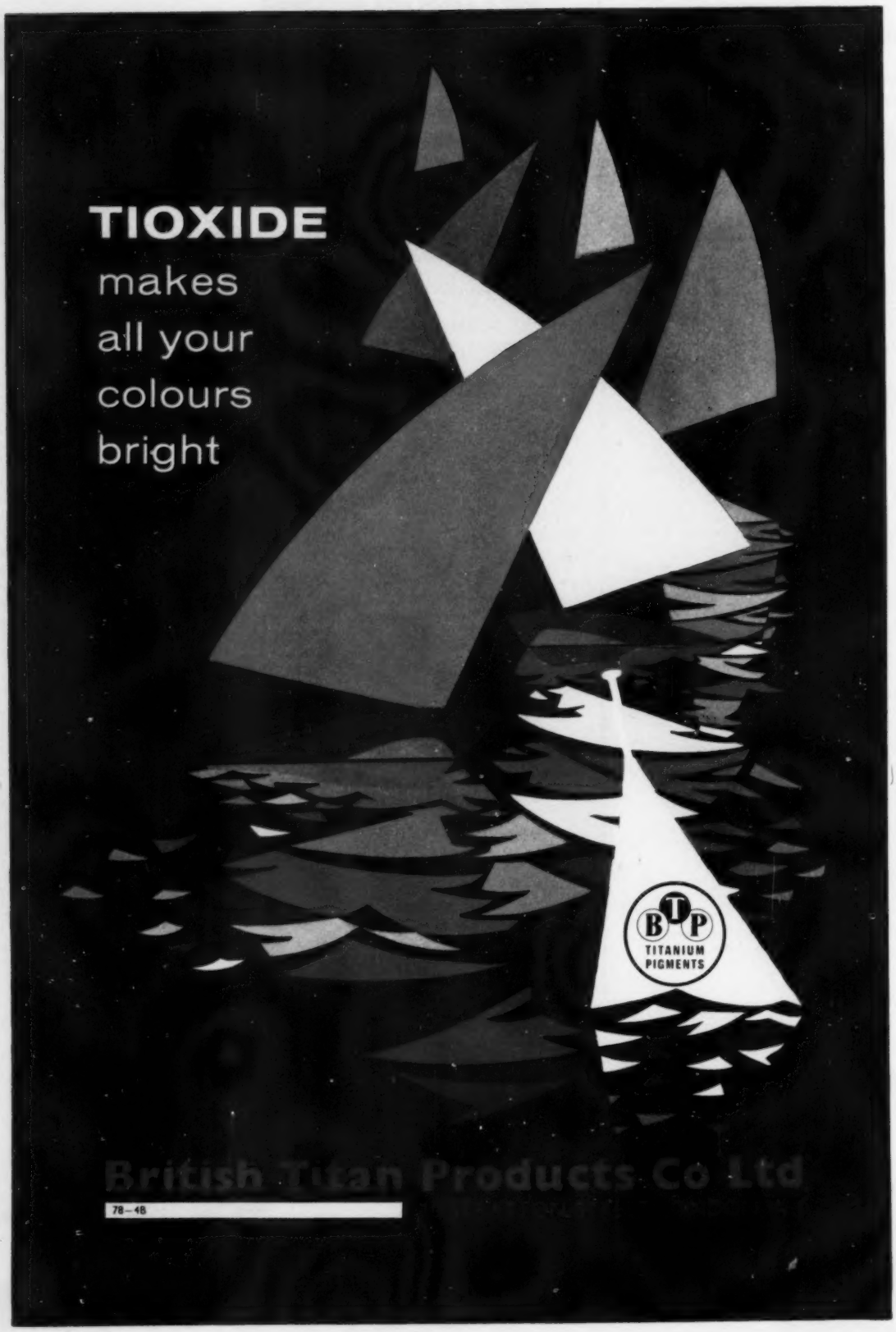
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Sommaire des principaux articles

Machines anglaises pour les marchés mondiaux 568

Cet article précise l'ampleur des exportations des machines anglaises pour le caoutchouc et les plastiques dans un certain nombre de pays. Les constructeurs de Grande-Bretagne opèrent de deux façons. Ils ont chacun des agents sur les principaux marchés de l'étranger et, en outre, il y a toujours eu une arrivée régulière de commandes négociées directement avec les grandes firmes de pneumatiques, de caoutchouc et de câbles dans le Royaume-Uni, aux USA et en Italie. Il y est également précisé l'effet du Marché Commun Européen et de la Zone de Libre-Echange Européenne sur les exportations de machines. Dans certains marchés, il faut avoir des conditions de crédit plus longues en ce qui concerne les commandes de l'étranger, et le Gouvernement devrait prendre des mesures pour le bien du commerce, tant à l'intérieur que pour les exportations. Une rapide expansion des réseaux routiers et des transports par la route, surtout en Europe orientale, a résulté en un accroissement très grand de la consommation des pneus et, de ce fait en de nouvelles grosses fabriques de pneumatiques. Il est question dans cet article du travail accompli par la Rustyfa Ltd., le consortium anglais de sociétés, dont Dr Mackay est Président, qui équipent des usines en Russie, en Roumanie et ailleurs.

L'industrie anglaise de fabrication des matières plastiques 570

Au cours des premières années de l'après-guerre, cette industrie a essuyé un sérieux échec, par suite des mauvaises applications que l'on fit des plastiques. Pourtant, au cours de ces derniers dix ans, toute la répugnance à employer les plastiques s'est trouvée presqu'entièrement éliminée et cette industrie ne cesse de se développer. Pendant les dix dernières années, la production s'est accrue de 155.000 tonnes à 500.800 tonnes.

Les exportations augmentent et la venue de l'EEC et de l'EFTA vont à la fois accroître les marchés et développer la concurrence. L'Europe orientale constitue aussi un important marché en puissance, qui n'est pas à négliger.

L'avenir promet, mais la qualité doit être le mot d'ordre de cette industrie.

On emploie encore beaucoup les plastiques phénoliques et aminés et, dans la catégorie des thermoplastiques, le chlorure de polyvinyle, le polythène et le polystyrène constituent un très fort tonnage. L'industrie des plastiques armés se développe aussi très rapidement et, depuis 1958, la production des polyesters a presque doublé.

Résines acrylonitriles-butadiènes-styrènes 572

Les résines acrylonitriles-butadiènes-styrènes ont été découvertes à partir de caoutchoucs synthétiques et, bien que l'on en dispose déjà depuis la fin de la guerre aux USA, on ne les utilise beaucoup en Grande-Bretagne que depuis 1956.

En modifiant les proportions des parties constituantes, on arrive à produire toute une gamme de matières que l'on peu classer d'après leurs propriétés de bonne résistance aux chocs. Leurs propriétés de résistance à la chaleur, aux produits chimiques et aux basses températures sont aussi remarquables.

Les machines de traitement thermoplastique classiques peuvent s'employer pour la fabrication d'une très grande diversité d'articles. Les résines acrylonitriles-butadiènes-styrènes coûtent plus cher que le polystyrène et le chlorure de polyvinyle rigide et c'est la raison pour laquelle on les emploie généralement dans des applications qui utilisent leurs propriétés au maximum.

Caoutchoucs et latex nitriles 575

Les caoutchoucs nitriles sont disponibles dans le commerce depuis vingt-cinq ans, et leur emploi ne cesse d'augmenter progressivement.

Les caoutchoucs nitriles ont pour principaux avantages la résistance aux huiles et aux principaux solvants, la résistance à l'abrasion et à la chaleur, ainsi que de bonnes propriétés mécaniques. Leurs utilisations se groupent en deux catégories, les caoutchoucs solides pour des applications qui exigent la résistance chimique, et les latex dans bien des domaines, y compris les industries du papier et textile.

Par un mélange avec d'autres polymères, on obtient des produits dont les propriétés ont vaincu les défauts inhérents aux nitriles. Par exemple, on arrive à améliorer considérablement la résistance à l'ozone par addition de chlorure de polyvinyle.

Les latex modifiés comprenant les groupes à l'acide carboxylique offrent une très haute résistance à la traction, propriété très précieuse en de nombreuses applications. Par combinaison avec la mélamine ou résines aminées, on produit des finis qui résistent au froissement et les latex s'emploient aussi beaucoup dans les étoffes non tissées.

EFTA et l'industrie anglaise des matières plastiques 578

CEE, EFTA et l'industrie anglaise du caoutchouc 582

Fabriqué en Angleterre 591-624

Adhésifs de caoutchouc 625

Du fait de leurs nombreux emplois et des progrès techniques ayant permis de les employer à la place des colles végétales et animales, l'utilisation des adhésifs à base de caoutchouc a quadruplé au cours de ces quatre dernières années.

Bien que les adhésifs à base de latex offrent certains avantages, ils sèchent lentement et l'on emploie les matières à base de solvants dans des emplois bien plus nombreux. L'industrie automobile est l'une de celles qui font la plus grosse consommation de ces adhésifs, une voiture exigeant en moyenne quatre à cinq litres. Malgré un prix plus élevé, les bases au néoprène remplacent le caoutchouc naturel pour de multiples applications, du fait de leurs propriétés supérieures de vieillissement et de leur résistance à la chaleur. Entre autres matières ayant des emplois spéciaux, citons le polyisobutylène, les éthers de polyvinyle et les copolymères butadiènes-acrylonitriles.

La coloration des plastiques 628

Les pigments que l'on emploie pour colorer les matière plastiques se classent en deux catégories, inorganiques et organiques. Les propriétés offertes par les pigments dépendent à la fois de la composition de la matière plastique et de la structure du pigment colorant lui-même. Les propriétés importantes nécessaires à ces matières sont la stabilité aux conditions du traitement, la stabilité à la lumière, la résistance à la formation, de craie ou efflorescence et à la migration. Les colorants peuvent nuire à certaines propriétés des plastiques dans lesquels on les emploie, telles que les valeurs électriques et le fini de surface. La dispersion du colorant dans les plastiques est importante et celle-ci peut se faire soit à sec, soit dans certains cas par prédispersion des pigments dans un véhicule approprié. Parmi les plastiques les plus récents, il en est de difficiles à colorer et l'on étudie la création de pigments colorants spécialement traités pour convenir à certains polymères, afin de surmonter de telles difficultés.

Les polymères dans l'industrie automobile 632

Les progrès des polymères depuis la seconde guerre mondiale ont été si rapides que le choix de nouveaux matériaux pour emploi dans l'industrie automobile est une tâche difficile. Avant d'avoir pu terminer les essais d'une matière, on dispose déjà de quelque chose de mieux. Cette situation est encore rendue plus compliquée du fait de la diversité des emplois du caoutchouc et des plastiques dans l'industrie. Afin que les industries de l'automobile d'une part, et des caoutchoucs et des plastiques d'autre part puissent tirer le maximum de profit l'une de l'autre, il faut établir une liaison plus étroite et il importe de mieux faire connaître les limites, les besoins et les possibilités de l'une et des autres. Les besoins de l'industrie automobile en ce qui concerne la résistance à la température, à l'humidité et aux liquides en service dans toute les parties du monde sont passés en revue dans cet article.

La technique dans les thermoplastiques 636

Les thermoplastiques tels que le méthacrylate de méthyle, le chlorure de polyvinyle, le polythène, le polystyrène et le nylon peuvent être formés et fabriqués par des méthodes très analogues à celles que l'on emploie pour les métaux. Les techniciens des plastiques ont adapté les machines et les méthodes existant actuellement à l'utilisation de ces matières. Les matières premières, tout comme pour les métaux, se présentent sous forme de barres, de blocs, de tiges, de tubes et de feuilles, ou plaques. On peut employer le matérial d'atelier normal, avec peut-être certaines modifications en ce qui concerne les vitesses de coupe et les angles des outils; on se sert aussi de scies circulaires et à ruban, de fraiseuses, de perceuses, de tours, de toupies et d'outiles finisseurs. Plus importants sont les procédés de formage qui exigent la chaleur et la pression et les presses et machines à faire le vide, ainsi que les moules employés en même temps, qui jouent un grand rôle dans la fabrication d'une diversité d'objets presqu'illimitée.

Exportation de l'industrie anglaise du caoutchouc 642

Equipement et Nouvelles 648

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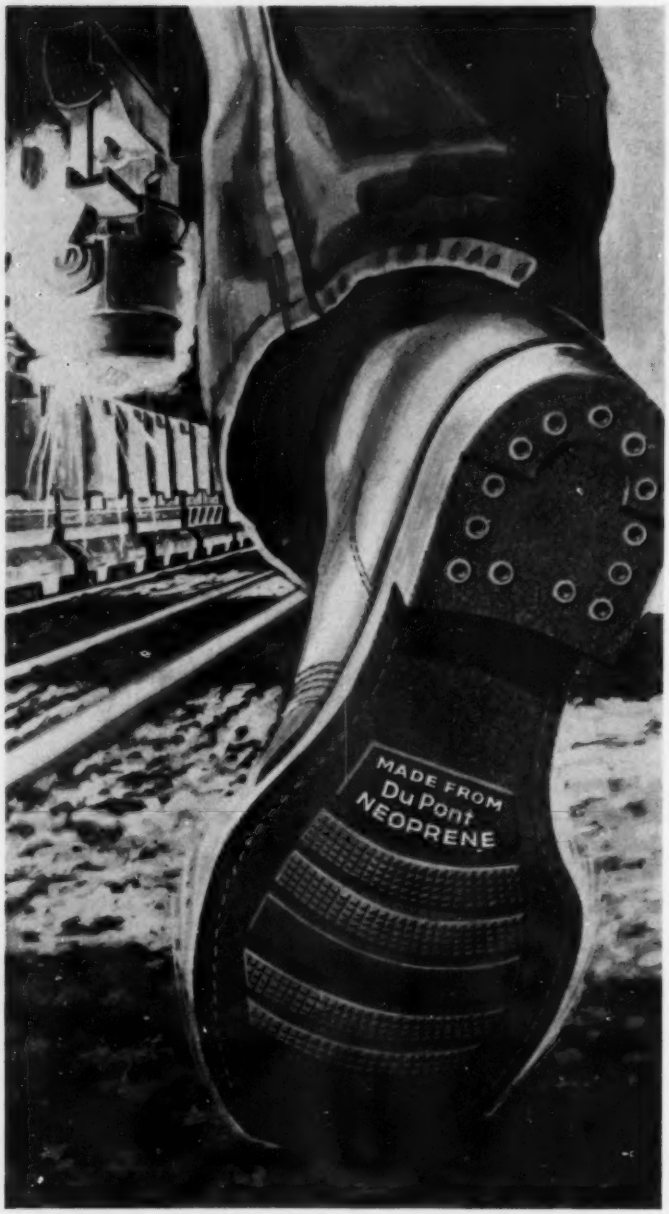

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Zusammenferssungen der Leitartikel

Britische Maschinen für den Weltmarkt 568

Das Ausmass der Ausfuhr britischer Kautschuk- und Kunststoffmaschinen nach einer Reihe von Ländern wird beschrieben. Britische Hersteller arbeiten auf zwei Arten. Jede Fabrik hat ihre Vertreter in den wichtigsten Auslandsmärkten, ausserdem laufen aber ständig Aufträge ein, die auf direkte Verhandlungen mit führenden Reifen-, Kautschuk- und Kabelfabriken in Grossbritannien, den Vereinigten Staaten und Italien zurückzuführen sind. Ferner wird der Einfluss des Europäischen Gemeinsamen Marktes und der EFTA (Europäische Freihandels-zone) auf die Ausfuhr von Maschinen beschrieben. In einer Anzahl von Märkten sind langfristige Kredite für Auslandsaufträge notwendig und die Regierung sollte die erforderlichen Massnahmen im Interesse des Inlands- und Exportgeschäftes treffen. Eine rasche Erweiterung des Strassennetzes und des so ermöglichten Strassentransports, besonders in Osteuropa, hat eine starke Steigerung des Reifenbedarfs zur Folge und neue, grosse Reifenfabriken werden erforderlich. Die Tätigkeit der Rustyfa Ltd. wird erwähnt, der britischen Gruppe von Gesellschaften unter dem Vorsitz von Dr. Mackay, die Werke in Russland, Rumänien und in anderen Ländern einrichtet.

Die britische kunststofferzeugende Industrie 570

Kurz nach dem Krieg erlitt die Industrie einen ernsthaften Rückschlag als Folge eines vielfach falschen Einsatzes der Kunststoffe. Im letzten Jahrzehnt jedoch ist die dadurch entstandene Abneigung gegen Kunststoffe weitgehend überwunden worden und die Industrie ist nunmehr in ständiger Entwicklung begriffen. In den letzten zehn Jahren ist die Produktion von 155.000 Tonnen auf 500.000 Tonnen gestiegen.

Der Export nimmt ständig zu; die EWG und die europäische Freihandelszone werden zwar die Märkte erweitern aber auch die Konkurrenz verstärken. Osteuropa ist auch ein grosser Zukunftsmarkt, der nicht vernachlässigt werden darf.

Die Zukunftsaussichten sind vielversprechend, aber die Kunststoffindustrie muss darauf achten, dass 'Qualität' ihr ständiges Motto bleibt.

Phenoplaste und Aminoplaste finden immer noch weiterverbreitete Anwendung; unter den Thermoplasten stellen PVC, Polyäthylen und Polystyrol einen grossen Teil der Kunststoffproduktion dar. Auch die Erzeugung von verstärkten Kunststoffen steigt rapid und die Polyesterproduktion hat sich seit dem Jahr 1958 fast verdoppelt.

Acrylnitril-Butadien-Styrol Harze 572

ABS-Harze sind aus dem Kunstkautschuk hervorgegangen. Obwohl sie in den Vereinigten Staaten schon seit Ende des Krieges erhältlich waren, gebinnt ihr grösserer Einsatz in Grossbritannien erst im Jahr 1956.

Durch Veränderung der Anteile der einzelnen Komponenten, ist es möglich, eine Reihe von Materialien herzustellen, die durch ihre gute Schlagfestigkeit charakterisiert sind. Wärme- und chemische Festigkeit, sowie Kältebeständigkeit sind auch hervorragend.

Die gebräuchlichsten Verarbeitungsmaschinen für Thermoplaste sind zur Produktion einer grossen Zahl von Artikeln geeignet. Die Kosten der ABS-Harze sind höher als die für Polystyrol and Hart-PVC, so dass diese Harze im allgemeinen auf Gebiete beschränkt werden, in denen ihre guten Eigenschaften voll ausgenützt werden können.

Niltrilkautschuk und Latices 575

Nitrilkautschuke sind schon seit 25 Jahren auf dem Markt und der Verbrauch wächst ständig.

Die Hauptvorteile des Nitrilkautschuk sind sein Widerstand gegen Öl, Lösungsmittel, Abrieb und Wärme, sowie seine guten mechanischen Eigenschaften. Seine Anwendungen fallen in zwei Gruppen: Fester Kautschuk für Verwendungszwecke, die chemischen Widerstand verlangen; und Latices, die in den verschiedensten Industrien, einschliesslich in der Papier- und Textilindustrie eingesetzt werden.

Durch Mischen mit anderen Polymeren ist es möglich die arteigenen Mängel des Nitrilkautschuk zu beseitigen. Die Beimengung von PVC, z.B., verbessert die Ozonfestigkeit bedeutend.

Modifizierte Latices, die Karbonsäuregruppen enthalten, besitzen hervorragende Reissfestigkeit, eine günstige Eigenschaft für viele Anwendungen. In Verbindung mit Melamin- oder Aminoharzen, erhält man knitterechte Ausrüstungen. Latices werden auch weitgehend in nichtgewebten Materialien eingesetzt.

Europäische Freihandelzone und die britische Kunststoffindustrie 578

EWG, EFTA und die britische Kautschukindustrie 582

In Grossbritannien hergestellt 591-624

Kautschukkleber 625

Die Vielseitigkeit der Kautschukkleber und technischen Fortschritte, die ihre Anwendung anstelle pflanzlicher und tierischer Leime ermöglichten, haben den Verbrauch dieser Kleber in den letzten vier Jahren um das Vierfache gesteigert.

Obwohl Latexkleber gewisse Vorteile aufweisen, haben sie den Nachteil langsam zu trocknen; auf Lösungsmittel aufgebaute Materialien werden daher weitgehend bevorzugt. Die Autoindustrie ist einer der grössten Verbraucher mit einem Durchschnittsbedarf von ungefähr 4.5 Liter pro Auto.

Trotz ihres höheren Preises, verdrängen die Neoprenprodukte den Naturkautschuk in vielen Gebieten wegen ihrer überragenden Alterungseigenschaften und Wärmefestigkeit. Andere Materialien für besondere Anwendungen sind Polyisobutylen, Polyvinyläther und Acrylnitril-Butadien Mischpolymerisate.

Färben von Kunststoffen 628

Die zur Färbung von Kunststoffen verwendeten Pigmente fallen in zwei Gruppen: anorganische und organische Pigmente. Die Eigenschaften der Pigmente richten sich nach der Kunststoffzusammensetzung sowie der Struktur der Pigmente selbst. Zu den wichtigen erforderlichen Eigenschaften gehören Standfestigkeit unter den verschiedenen Verarbeitungsbedingungen, Lichtbeständigkeit, Widerstandsfähigkeit gegen Abkreiden oder Anlaufen und gegen Wanderung. Pigmente können Eigenschaften von Kunststoffen, in denen sie verwendet werden, wie z.B. deren elektrische Werte und Oberflächenbeschaffenheit nachteilig beeinflussen. Dispersion der Pigmente im Kunststoff ist wichtig; diese Dispersion kann entweder trocken durchgeführt werden oder in gewissen Fällen durch 'Vordispersion' des Pigments in einem geeigneten Mittel. Einige der neueren Kunststofftypen lassen sich schwer färben und es wird an der Vorbehandlung von Pigmenten für bestimmte Polymere gearbeitet, um diese Schwierigkeiten zu überwinden.

Polymere in der Autoindustrie 632

Seit dem zweiten Weltkrieg ist die Entwicklung der Polymere so stürmisch vor sich gegangen, dass die Autoindustrie es nicht leicht findet, unter den vielen neuen Materialien die richtige Wahl zu treffen. Kaum sind die Versuche mit einem Produkt abgeschlossen, schon ist etwas Besseres auf dem Markt erschienen. Diese Lage ist durch die Vielfalt der Kautschuk- und Kunststoffanwendungen in der Autoindustrie noch weiter erschwert. Engerer Kontakt zwischen den Auto- und Kautschuk, sowie den Kunststoffindustrien ist daher wünschenswert, um eine gegenseitig nützliche Zusammenarbeit zu erzielen und auch um die Grenzen, Erfordernisse und Möglichkeiten beider Industrien klarer zu definieren. Die Bedürfnisse der Autoindustrie im Hinblick auf Temperatur-, Feuchtigkeits- und Flüssigkeitswiderstand ihrer Produtke in allen Teilen der Welt wird beschrieben.

Verfahrenstechnik für Thermoplaste 636

Thermoplaste, wie Methylmethacrylat, PVC, Polyäthylen, Polystyrol und Nylon können nach Methoden, die denen der Metallverarbeitung ähnlich sind, geformt und bearbeitet werden. Kunststofftechniker haben herkömmliche Maschinen und Verfahren der Verarbeitung dieser Kunststoffe angepasst. Wie bei den Metallen, fallen die Rohmaterialien als Stangen, Blöcke, Stäbe, Rohre und Platten an. Die normale Maschinenausrüstung eignet sich zur Verarbeitung, eventuell mit einigen Änderungen der Schneidegeschwindigkeiten und Winkel: Rund- und Bandsägen, Fräsmaschinen, Bohrer, Drehbänke, Oberfräser usw. Die Formverfahren, die Wärme und Druck benötigen, sind jedoch noch wichtiger. Die Pressen und Vakuumformmaschinen und die dazugehörenden Formen spielen eine äusserst grosse Rolle in der Erzeugung einer fast zahllosen Reihe von Artikeln.

Export der britische Kautschukindustrie 642

Anlagen usw Umschau 648

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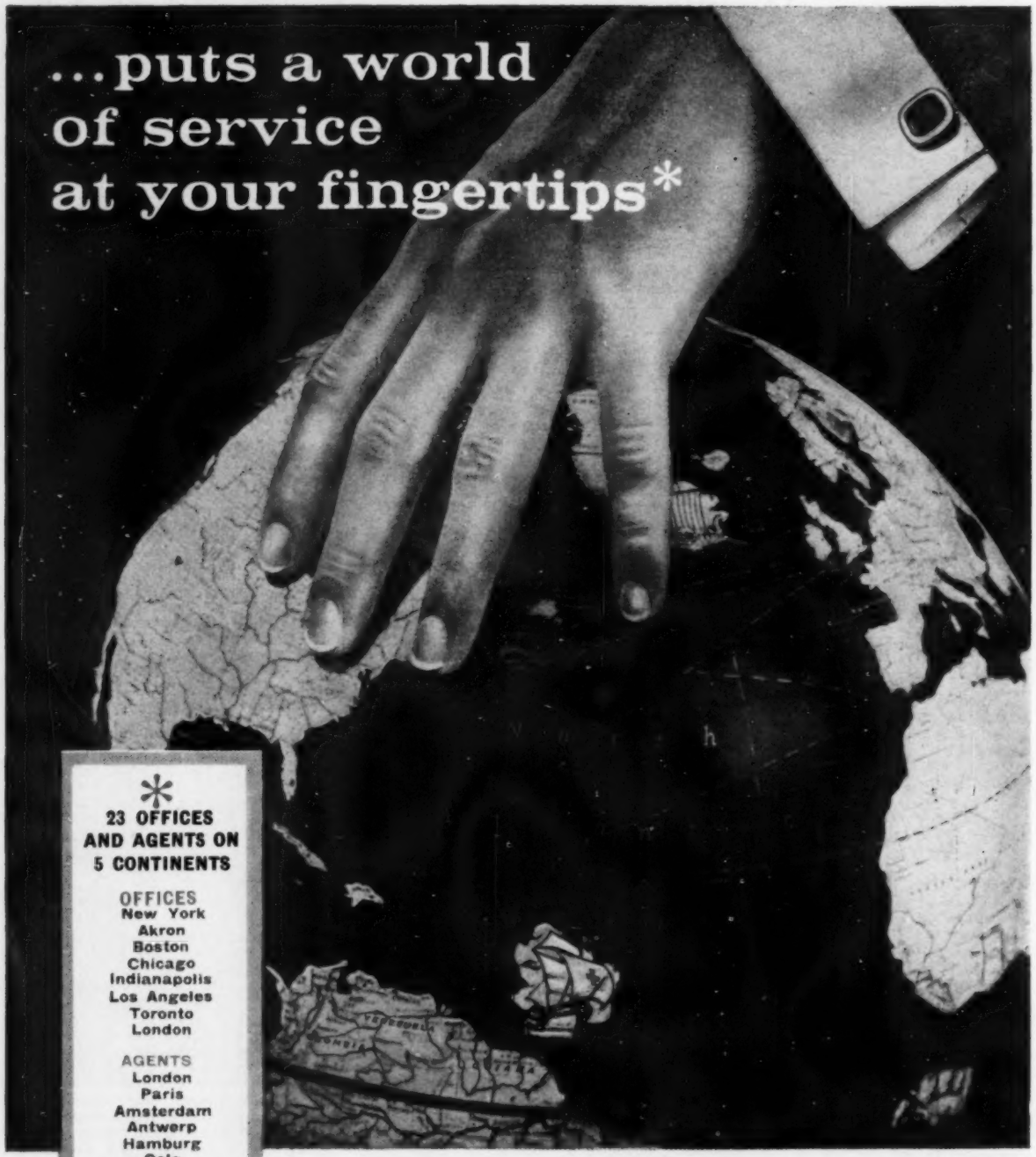

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Sommari degli articoli principali

Macchinario Britannico per i mercati del mondo 568

Si delinea la portata delle esportazioni di macchine britanniche per la gomma e la plastica a diversi paesi. I costruttori del Regno Unito lavorano in due modi. Ciascuno di essi ha rappresentanti nei principali mercati stranieri ed inoltre v'è stata sempre una corrente continua di ordinazioni conseguite direttamente dalle principali società di pneumatici, gomme e cavi del Regno Unito, degli Stati Uniti e dell'Italia. Si prospetta l'influenza del Mercato Comune Europeo e della Zona Europea del Libero Scambio sulle esportazioni di macchinari. In alcuni mercati è necessario dare credito a lungo termine per le ordinazioni estere ed occorrerebbero misure governative onde agevolare il commercio nazionale come anche quello di esportazione. Un rapido sviluppo delle costruzioni e dei trasporti stradali, specialmente nell'Europa orientale, si traduce in un grande aumento del consumo di pneumatici e quindi in nuove grandi fabbriche di pneumatici. Si fa presente il lavoro della Rustyfa Ltd., consorzio di fabbriche del Regno Unito formato per equipaggiare fabbriche in Russia, in Rumani ed altrove, della quale il Sig. Dott. Mackay è Presidente.

L'industria manufatturiera britannica della plastica 570

Negli anni immediatamente susseguenti al dopo guerra le cattive applicazioni della plastica causarono una forte recessione nell'industria. Negli ultimi dieci anni però ogni riluttanza all'impiego della plastica è stata in gran parte eliminata e l'espansione dell'industria continua. Negli ultimi dieci anni la produzione è aumentata da 155.000 a 500.800 tonnellate.

Le esportazioni sono in rialzo e l'avvento della MEC e della EFTA accrescerà ambedue i mercati e la concorrenza. L'Europa orientale è anche un gran mercato potenziale che non deve essere trascurato.

Le prospettive sono buone ma la parola d'ordine dell'industria deve essere la qualità.

I fenolici e gli aminoplastici sono largamente usati e fra i termoplastici il PVC, il politene ed il polistirene rappresentano un forte tonnellaggio. L'industria della plastica armata si va anche estendendo rapidamente e la produzione di poliesteri è quasi raddoppiata dal 1958.

Resine Acrilonitrilo-Butadiene-Stirolo 572

Le resine ABS sono state realizzate partendo dalle gomme sintetiche e sebbene esse siano state disponibili negli Stati Uniti sin dalla fine della guerra, il loro impiego in grande scale nel Regno Unito data soltanto dal 1956.

Variando le proporzioni dei costituenti si può produrre una gamma di materiali che sono caratterizzati dalle loro buone proprietà di resistenza all'urto. Le loro proprietà di resistenza al calore e agli agenti chimici e di bassa temperatura sono anche eccezionali.

Si possono usare macchine convenzionali di lavorazione termoplastica onde produrre una grande varietà di articoli. Il costo delle resine ABS è maggiore di quello del polistirolo e del PVC rigido e per tale motivo esse sono generalmente impiegate in applicazioni che permettono un ampio uso delle loro proprietà.

Gomme e Lattici Nitrilici 575

Le gomme nitriliche sono state disponibili nel mercato de 25 anni ed il loro consumo va aumentando progressivamente.

I vantaggi principali delle gomme nitriliche si riscontrano nella loro resistenza agli oli ed ai solventi, resistanza all' abrasione ed al calore e nelle loro buone proprietà meccaniche. Gli usi comprendono due categorie, e cioè gomme massicce per impieghi che richiedono resistenza chimica e lattici in molti campi, fra i quali le industrie della carta e tessili.

Si possono produrre miscele con altri polimeri aventi proprietà che annullano i difetti impliciti dei nitrili. Così per esempio la resistenza all'ozono può essere notevolmente aumentata mediante l'aggiunta di PVC.

I lattici modificati contenenti gruppi dell'acido carbossilico hanno un'altissima resistenza alla trazione, proprietà che è utile in molti impieghi. In combinazione con melamina o resine aminiche si producono finissaggi resistenti alle pieghe ed i lattici sono anche ampiamente usati in stoffe non tessute.

EFTA e l'industria britannica della plastica 578

MEC, EFTA e l'industria britannica della gomme 582

Fabbricazione Britannica 591-624

Adesivi a base di gomma 625

Data la loro versatilità ed i progressi tecnologici che ne hanno reso possibile l'uso in lugo delle colle vegetali ed animali, l'impiego degli adesivi a base di gomma si è quadruplicato negli ultimi quattro anni.

Sebbene gli adesivi a base di lattice abbiano alcuni vantaggi, essi sono ad essiccamento lento ed i materiali a base di solventi hanno un impiego molto più vasto. L'industria automobilistica è una delle più grandi consumatrici di tali adesivi, dato che la vettura ordinaria ne richiede oltre quattro litri.

Nonostante il loro maggi orcosto, le basi di neoprene stanno rimpiazzando la gomma naturale in molte applicazioni, dato che hanno caratteristiche d'invecchiamento e resistenza al calore superiori. Fra gli altri materiali per usi speciali si annoverano il poli-isobutilene, gli eteri polivinilici ed i capolimeri butadiene-acrilonitrilici.

Tinteggiatura della plastica 628

I pigmenti impiegati nella tinteggiatura della plastica vengono classificati in due gruppi, quello organico e quello inorganico. Le proprietà estibite dai pigmenti dipendono sia dalla composizione plastica che dalla struttura stessa del pigmento. Fra le proprietà importanti che si richiedono per questi materiali va compresa la stabilità rispetto alle condizioni di lavorazione, stabilità alla luce, resistenza allo sfarinamento e al velamento e alla migrazione. I pigmenti possono avere un'influenza dannosa su alcune delle proprietà della plastica nella quale sono usati, quali per esempio le caratterisctiche elettriche e la finitura superficiale. La dispersione del pigmento nella plastica è importante ed essa può essere effettuata o a secco o in alcuni casi predisponendo il pigmento in un mezzo adatto. Alcune delle plastiche più recenti sono di difficile tinteggiatura e si stanno elaborando dei pigmenti trattati in modo speciale per polimeri specifici onde superare tali difficoltà.

Polimeri nell'industria automobilistica 632

Il progresso dei polimeri a partire dalla seconda guerra mondiale è stato tanto rapido che il compito di scegliere nuovi materiali da impiegare nell'industria automobilistica è difficile. Prima ancora che le prove su di un determinato materiale siano terminate, si presenta già qualche altro materiale migliore. Questo stato di cose viene aggravato ulteriormente dalla diversità di applicazioni della gomma e della plastica nell'industria. Onde le industria dell'automobile, della gomma e della plastica debbano ricavare il massimo vantaggio reciproco, si richiede una collaborazione più intima ed occorre che le limitazioni, le limitazioni e le possibilità di ciascuna di esse siano più ampiamente note. Si descrivono le esigenze dell'industria automobilistica per quanto concerne temperatura, umidità e resistenza ai fluidi in condizioni di servizio in ogni parte del mondo.

La meccanica nella produzione dei termoplastici 636

I prodotti termoplastici tali quali il metacrilato metilico, PVC, politene, polistirolo e nailon possono essere modellati e fabbricati in base a metodi molto simili a quelli impiegati per i metalli. I tecnici della plastica hanno adattato macchine e metodi già esistenti all'impiego di tali materiali. Come nel caso dei metalli, le materie prime sono sotto forma di barre, blocchi, aste, tubi e lastre. Si può far uso dell'attrezzatura normale di officina, salvo forse qualche leggiera modificazione in materia di velocità di taglio ed angolo di utensili: seghe circolari ed a nastro—fresatrici, trapani, torni, taboretti e smerigliatrici a nastro. Più importanti ancora sono i processi di modellatura che richiedono calore e pressione e quindi le presse e le macchine modellatrici a vuoto ed i modelli usati con esse hanno una funzione importante nella produzione di una varietà quasi illimitata di prodotti.

Le esportazioni l'industria britannica della gomme 642

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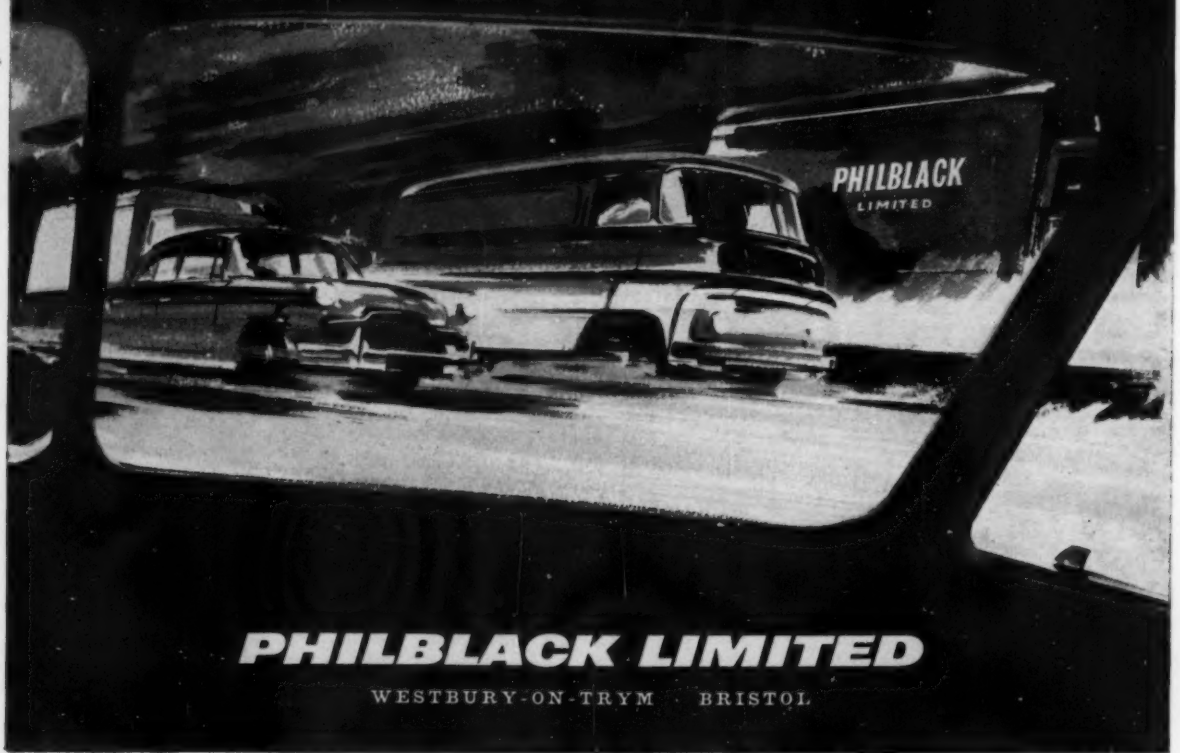

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NOTES of the WEEK

Made in Britain

DURING the last few weeks, officially published figures show that exports of the products of the British rubber and plastics manufacturing industries, and of the plastics raw material industry, continue to increase. In plastics raw materials, for instance, exports for the first seven months were valued at over £26m., compared to £12m. for the same period in 1959. The fact that trade is two-way is indicated by the rise of imports of these materials from £10.9m. for January-July, 1959, to £17.4m. for the first seven months of 1960. Exports of rubber products, other than tyres and tubes, amounted to over £11m. for the same period as against £9.5m. in the first half of 1959. Exports of tyres and tubes are up by more than £2m. for the half-year over the first half of 1959.

It is unfortunate that no account is kept of rubber and plastics products exported as integral parts of the finished products of other industries. Things like refrigerators, sports and household goods and machinery, etc. In an average passenger car, for instance, there is 120lb. and upwards of rubber (including tyres) and upwards of 13lb. of plastics. In 1959, UK exports of cars were valued at £215,761,850.

Illustrated and described in this issue (pages 591 to 624) are some of the products of the British rubber and plastics manufacturing industries. Summaries of the principal articles in this issue will be found on pages 559, 561 and 563, in French, German and Italian.

Fabrication Anglaise

AU cours des dernières semaines, les chiffres officiellement publiés montrent l'accroissement continuel des exportations des produits des industries manufacturières anglaises du caoutchouc et des plastiques, ainsi que de ceux de l'industrie des matières premières plastiques. Par exemple, pour les matières premières plastiques, on a évalua à plus de 26 millions de livres sterling lex exportations des sept premiers mois, alors que, pourl a même période en 1959, elles n'étaient que de 12 millions. Le fait que le commerce existe dans les deux sens est démontré par l'augmentation des importations de ces matières de 10.9 millions de livres pour la période janvier-juillet 1959 à 17.4 millions pour les sept premiers mois de 1960. Les exportations de produits du caoutchouc, autres que les bandages et les chambres pneumatiques, atteignaient plus de 11 millions de livres pour la même période, par comparison avec 9.5 millions dans la première motié de 1959. Les exportations de pneus et de chambres à air se sont accrues de plus de 2 millions, pour le semestre, par rapport à la première motié de 1959.

Il est regrettable que l'on ne tienne aucune comptabilité des produits en caoutchouc et en plastiques qui sont exportés en tant que parties intégrantes des articles finis des autres industries, par exemple des fabrications telles que les réfrigérateurs, les articles de sport et ménagers, les machines, etc. Prenons le cas d'une voiture de tourisme moyenne, on y trouve jusqu'à plus de cinquante kilogs de caoutchouc (pneus compris) et jusqu'à 5 à 6 kilogs de plastiques. En 1959, on estimait les exportations d'automobiles anglaises à £215,761,850.

Ce numéro contient (pages 591 à 624) des illustrations et descriptions de certains des produits des industries manufacturières anglaises du caoutchouc et des plastiques. Les principaux articles dans ce numéro de *RJIP* sont résumés en page 559.

In Grossbritannien Hergestellt

OFFIZIELLE, in den letzten Wochen veröffentlichte Daten, beweisen, dass die Ausfuhr von Erzeugnissen der britischen Kautschuk- und Kunststoffindustrien, sowie der Kunststoffrohmaterialien weiter steigt. Die Ausfuhr von Rohmaterialien für Kunstoffe für die ersten sieben Monate wird z.B. auf über £26m. geschätzt, verglichen mit £12m. für den gleichen Zeitraum im Jahre 1959. Diese Rohmaterialien werden aber nicht nur ausgeführt, sondern auch eingeführt und der Import stieg von £10.9m. für den Zeitraum von Januar bis Juli 1959 auf £17.4m. in den ersten sieben Monaten des Jahres 1960. Die Ausfuhr von Kautschukerzeugnissen, ausgenommen Autoreifen und Schläuche, betrug für den gleichen Zeitraum über £11m. verglichen mit £9m. in der ersten Hälfte 1959. Die Ausfuhr von Reifen und Schläuchen im ersten Halbjahr übersteigt den Wert für den gleichen Zeitraum 1959 um über £2m.

Es ist bedauerlich, dass es keine Zahlen über die Ausfuhr von Kautschukund Kunststoffartikeln gibt, die als wesentliche Bestandteile der fertigen Artikel anderer Industrien exportiert werden: wie z.B. von Kühlschränken, Sport- und Haushaltsartikeln und Maschinen u.ä. Ein Personenauto enthält z.B. durchschnittlich mindestens 55 kg. Kautschuk (einschliesslich Reifen) und wenigstens etwa 6 kg. an Kunstoffen. Im Jahre 1959 betrug der Wert der ausgeführten Automobile £215,761,850.

In dieser Ausgabe (Seiten 591 bis 624) sind einige Erzeugnisse der britischen Kautschuk- und Kunststoffindustrie abgebildet und beschrieben. Zusammenstellungen der wichtigsten Artikel sind auf Seite 561.

Fabbricazione Britannica

LE statistiche ufficiali, pubblicate nelle ultime settimane mostrano che le esportazioni di prodotti delle industrie manufatturiere britanniche della gomma e della plastica e dell'industria delle materie prime per plastica hanno continua to ad aumentare. Cosi per esmpio, in materia di materie prime per plastica le esportazioni nei primi sette mesi furono di oltre £26m. in confronto di £12m. per il periodo corrispondente del 1959. Il fatto che il commercio si muove in doppio senso è dimostrato dall'aumento delle importazioni di tali materiali che sono salite da £10.9m. per il periodo Gennaio-Luglio 1959 a £17.4m. per i primi sette mesi del 1960. Le esportazioni di prodotti di gomma, a parte i pneumatici e le camere d'aria, sono state di oltre £11m. durante tale periodo contro £9.5m. per la prima metà del 1959. Le esportazioni di pneumatici e di camere d'aria sono aumentate di oltre £2m. nel primo semestre rispetto al primo semestre del 1959.

Sfortunatamente non si sono tenuti dati statistici dei prodotti di gomma e di plastica esportati quali parti integrali dei prodotti finiti di altre industrie, come per esempio frigoriferi, articoli sportivi e domestici, macchine, ecc. Cosi per esempio, in un'automobile ordinaria per servizio passeggeri vi sono più di 54 kg. di gomma (compresi i pneumatici) e più di 6 kg. di plastica. Nel 1959 le esportazioni di automobili raggiunsero il valore di £st.215,761,850. All pagin 563 si troveranno i sommari degli articoli principali.

NEWS *Briefs*

HULS RAISES PLASTICS OUTPUT — JAPANESE NEOPRENE VENTURE — USA STOCKPILE SALES TWO BLACK PROJECTS — POLYMERS IN BRAZIL

Germany — Chemische Werke Hüls have announced that their polystyrene production capacity will be 30,000 tons a year by end 1961. By the same time, PVC capacity will be 80,000 tons. A plant for the production of 3,600 tons annually of polypropylene will be finished by the end of this year.

United States — The General Services Administration has announced that September sales of crude natural rubber from the national stockpile of strategic materials totalled 4,691 long tons. At the end of the September quarter there remained for sale 380,885 long tons of crude rubber.

Brazil — Leningrad specialists have started designing a plant to process combustible shale for Brazil, to be erected in the region of the huge bituminous shale deposits of the River Paranaiba. It will be the third biggest of its kind in the world, after two Soviet plants, and is expected to produce over 35 million cu. ft. of gas a day. Soviet specialists have visited Brazil and on the basis of their survey have decided to follow the system tested at Soviet plants. The first section of the plant will manufacture gas; the second, rubber, polythene, and other products.

Philippines — Directors of Goodrich International Rubber Co. of the Philippines have declared a cash dividend of 0.40 peso per share.

Holland — The first tyre remoulding factory in Holland has been opened at Tilburg by Goodyear (Nederland) N.V., a wholly-owned subsidiary of the Goodyear Tire and Rubber Company. Work has already started on an extension which will bring the total floor area to 60,000 sq. ft.

Japan — The Japanese Government's Foreign Investment Council approved on October 5 plans for a joint Japanese/American venture for the production of neoprene. A new company, the Showa Neoprene Company, would be established jointly by the Showa Denko Kaisha and Du Pont. Approval of the venture is conditional upon restricting production of the new firm to 8,000 tons annually, to leave room for Japanese companies to develop their own techniques of producing neoprene without foreign assistance.

United States — The United Carbon Company announced plans to construct a $5m. carbon black plant with an initial capacity of 64m. lb. in southern California. The new plant is expected to be in production next year.

Germany — Houdry Process Corporation of Philadelphia and Chemische Werke Hüls of Marl, West Germany, are forming a jointly owned company to develop, manufacture, and sell each company's line of catalysts. The new firm, Katalysatorenwerke Houdry-Hüls GmbH, will be located in Marl/Kreis Recklinghausen, where catalysts will be produced and sold to the rapidly growing Western European market.

Northern Ireland — One of the world's biggest manufacturers of tyre valves — the Bridgeport Brass Co., of Connecticut — are to start production in Northern Ireland. The Ulster company — Bridgeport Brass Ltd. — will occupy a 73,000 sq. ft. factory at Lisburn, Co. Antrim, which will produce tyre valves and valve accessories, is expected to employ 400. This is the second European operation established in recent months by the Connecticut firm.

Singapore — Rubber exports during September totalled 85,551 tons (August, 84,232), according to official preliminary figures published here on October 6.

South Africa — The carbon black plant being built at Port Elizabeth by Phillips Carbon Black Co. (Pty.) Ltd. (*RJIP* December 19 1959, p. 817), is now scheduled to be completed by December 1.

United States — Price increases of 2½ to 5% of off-the-road tyres and tubes were announced by the B. F. Goodrich Company, effective on October 10.

Rhodesia — The Federal Government of Rhodesia and Nyasaland is said to be considering a plan for an oil refinery in the Federation to make refined products from crude oil, following an approach by American financial and oil interests. Raw materials for carbon black and plastics might be produced. If the scheme is carried out, the refinery will probably be in production in three years' time.

"'What's this?" I says. "Plastic" he says. "Dammit" I says, "I know that— what sort of plastic?" "Blue," he says ...'—506

BHC £10m. Expansion Project

SOUTH WALES SITE FOR MAJOR NEW PLANT

BRITISH Hydrocarbon Chemicals Ltd. is planning to set up a £10m. manufacturing plant in South Wales, as briefly reported in *RJIP* October 1. The projected site for this is at Llandarcy, near Swansea.

Up till now, BHC has confined its manufacturing operations to its Grangemouth complex. As at Grangemouth, the new plant — on a site of several hundred acres — will be near a BP refinery, which will feed it with raw materials. The company is jointly owned by British Petroleum and the Distillers Co.

The company says that the introduction of a new and important industry into South Wales 'will make a welcome contribution to the economy of the area.'

Capital authorizations have not yet been approved, and no details are available yet of construction plans.

Still Expanding

BHC has been actively engaged in petrochemicals at Grangemouth for nearly ten years, and the company is still expanding there. When present plans are completed well over £35m. will have been spent there since 1951. Three major plants are expected to be completed at Grangemouth next year. One plant will produce ethylene dichloride, and another methanol — used for making synthetic resins. A third will more than double the existing butadiene capacity.

The latest plant to come on stream at Grangemouth was the £4m. synthetic phenol plant, which began production in March this year.

BHC say that the general pattern of operations at the projected plant can be expected to follow that at Grangemouth.

Formica Slow-Down

During his address to shareholders of the De La Rue Co., A. G. Norman, managing director, referred to the temporary introduction of a four-day working week at the Tynemouth factory of Formica. He said it was a temporary expedient which had been brought about by hire purchase restrictions and their effect on the furniture industry. 'We are continuing to invest heavily in the Formica business and regard it as a business in the early stages of its development,' he added.

Additional investment in Formica would be devoted to development of new products and improvements to existing products which could be expected in the next year or so.

PRICE FLUCTUATIONS

Malaya told the United Nations General Assembly in New York on October 10 that it was greatly concerned about the fluctuations in the prices of primary commodities.

Dato Nik Ahmed Kamil, chief Malayan delegate, in a policy speech to the Assembly said: 'In view of our great dependence on the exports of primary commodities for the financing of a steady and sustained programme of economic development, we are greatly concerned about fluctuations in prices.

The delegate urged that an international agreement on price stabilization should be looked for. He said: 'We appreciate that it is very difficult to establish an international price stabilization scheme in respect of rubber. But we are very pleased to note that the International Rubber Study Group has accepted the importance of greater stability, and that the Group has directed its management committee to study various possible measures to reduce the excessive fluctuations in the price of natural rubber.'

Dowty in Malta

DOWTY Seals Ltd. is to set up a subsidiary in Malta to manufacture synthetic rubber seals for hydraulic and pneumatic equipment. About 120 Maltese workers will be employed initially.

The subsidiary — to be called Malta Rubber Ltd. — will export all its output. As in the case of many other projects under Malta's Aids to Industries Scheme, the Malta Government is providing a modern factory on its industrial estate, a capital grant, a 10-year income tax holiday and exemption from customs duties on plant.

Commenting on the announcement, Sir George Dowty, Chairman of the Dowty Group, said: 'This move has been brought about largely because of rapid business expansion and acute labour shortages in our present seals factory. Malta offers the ideal solution to our problems because it has plenty of the right sort of labour, and has many other advantages.'

Sir George added that the existing seals factory was being extended.

Night shot of part of the Grangemouth petrochemical complex. The pattern of operations at the new £10m. Llandarcy project is expected to follow that at Grangemouth

E2

British Machinery for World Markets

EXPORTS FOR RUBBER AND PLASTICS INDUSTRIES CAN BE INCREASED

By J. G. MACKAY

BRITISH manufacturers of rubber and plastics machinery have a long tradition of overseas sales. It was natural that the rubber industries of other lands should seek their equipment in the country where Hancock, Macintosh and Dunlop made their pioneering discoveries. Co-operating closely in machine development with their customers in the home market and always ready to seek manufacturing licences for developments from abroad, British manufacturers of rubber machinery have kept pace with world-wide progress in their original field, and with the advent of plastics have played a major part in the growth of that industry also. Prior to the Second World War, orders came from all potential markets, with Commonwealth and European countries predominating. The Eastern European countries, now in the Communist bloc, were substantial buyers. A calender supplied by a British manufacturer before the First World War was still doing good work in a Russian tyre factory in 1956. Between the World Wars, British manufacturers equipped two large tyre factories in the USSR and two medium-size tyre plants in Poland.

Sales of rubber and plastics machinery overseas have hitherto been secured in two ways. Each manufacturer has agents in the principal foreign markets whose efforts are stimulated and supported by visits from directors and senior executives. But, in addition, there has always been a steady flow of export orders negotiated directly with major tyre, rubber and cable companies in the UK, USA and Italy for their overseas subsidiaries. The figures tabulated below do not fully indicate the industry's 'dollar earnings' because during 1960 rubber and plastics machinery worth about $1,500,000 will be shipped from this country to overseas subsidiaries of American companies.

THE AUTHOR

JOHN GEORGE MACKAY, C.B.E., Ph.D., B.Sc., F.I.R.I., A.R.I.C., is chairman of Francis Shaw & Co. Ltd. A Vans Dunlop scholar of Edinburgh University, where he graduated B.Sc. with first-class honours in chemistry and proceeded to Ph.D., Dr Mackay spent some years with the North British Rubber Co. Ltd. before joining the Avon India Rubber Co. Ltd. in 1931. *In* 1946 *he was appointed to the Board and subsequently to the Boards of the Avon subsidiaries George Spencer Moulton and Avon Footwear Sales Ltd. In* 1956 *he resigned to join the Board of Francis Shaw, becoming chairman in* 1959. *He played an active part in the formation of Rustyfa Ltd. during* 1957. *He is a former vice-chairman of the Rubber Manufacturing Employers' Association: serves on the research committee of RABRM and is a member of the Board of BRPRA.*

The export figures for 1958, 1959 and 1960 demonstrate the influence of shipments to the new Soviet factory at Dneipropetrovsk against the £15 million contract secured by the Rustyfa consortium in which Francis Shaw and Company Ltd. and David Bridge and Company Ltd. are participating. Shipments by Rustyfa Ltd. against their £7½ million order from Roumania have just started and will continue until the third quarter of 1961.

The Australian figures do not reflect the rapid expansion of the rubber and plastics industries in that country. Local manufacturers protected by a high tariff and operating under American and British licences have reduced imports to specialities not yet made in the country.

In the past valuable orders for rubber and plastics machinery came to the United Kingdom from countries now in the European Common Market, but in recent years capacity has been substantially expanded in Western Germany, France and Italy, and competition in this area has become very keen, with local producers enjoying substantial tariffs in France and Italy. To meet these difficulties one British manufacturer has appointed a licensee in France and made arrangements for manufacture in Holland and Italy.

There is only limited local manufacture within the other countries of the European Free Trade Area. In the past this has led to keen competition between the principal producers from overseas. As tariffs within the European Free Trade Area are reduced, there would seem to be opportunity in these territories for more exports from Britain.

From 1910 until the outbreak of the Second World War, plantation equipment was a major product of the British rubber machinery industry but recently local manufacture in Malaya has provided competition that is difficult to match. Nevertheless some business is still being done.

Reference has already been made to the activities of Rustyfa Ltd. In countries where road transport must be rapidly expanded, and this is a major necessity in Eastern Europe, the consequent increase in the consumption of tyres is so great that investment in new large tyre factories is well justified. To the national organizations responsible for erecting these plants, there are considerable advantages in placing a 'package deal' contract with one seller. The partnership of Rustyfa Ltd. and Dunlop Advisory Service Ltd. provides skilled experience of modern rubber machinery, expert planning of layouts, conveyors and utilities, and the services of a general contractor for the detail of procurement and shipment.

Credit on Overseas Orders

It is becoming increasingly necessary for manufacturers of rubber equipment to arrange payment on credit terms for orders from overseas. It is usual to insure such arrangements with the Export Credits Guarantee Department. For larger contracts use is also made of the Bankers' Guarantee Addendum to the ECGD Policy, so that 85/90%

of the credit may be recovered immediately by the machinery manufacturer by discounting bills or by an advance from his bank against these bills without recourse. The 10/15% remaining must be financed by the machinery manufacturer from his own resources. This limits the total sum which can be outstanding on long term credit at any one time. Manufacturers of rubber and plastics machinery have been greatly helped by ECGD in expanding their exports to exports of machinery which our Government could provide would be so to amend taxation on Company profits that manufacturers would be left with more cash for re-equipment for which in many rubber factories there is still great need. Not only would machinery manufacturers gain thereby more opportunities for developing improved machines in co-operation with their home market customers, but there would follow the even greater benefit of more economic manufacture of machines through longer runs to supply a more stable home market.

RUBBER AND PLASTICS WORKING MACHINERY

EXPORTS FROM THE UNITED KINGDOM—£'000

	1955	1956	1957	1958	1959	1960 1st Qtr.
Presses, plastic moulding, hydraulic	640	740	810	919	1182	344
Rubber and Plastics working machinery	1810	1670	2310	4683	9760	3030
TOTAL (all countries)	2450	2410	3120	5602	10942	3374
Principal countries to which shipments were made from the above totals:						
Australia	229	96	195	154	281	Nil
Bulgaria	—	—	—	—	179	180
France	155	251	238	275	286	56
Germany (West)	326	274	307	433	530	113
India	107	183	298	796	322	61
Rhodesia and Nyasaland ..	17	14	23	426	205	12
South Africa	297	220	203	288	261	87
USA	50	69	74	136	249	52
USSR	—	4	26	1837	6545	2139
Yugoslavia	—	—	—	—	151	—

but periods of post shipment credit longer than five years are not at present covered by the Department. In certain South American markets, it is the policy of the local Government only to approve an import of machinery if seven years post shipment credit is provided. In consequence of this restriction, British manufacturers of rubber and plastics machinery have lost business in South America to their West German competitors.

After the Suez crisis, demand for rubber machinery within the UK dropped sharply, and did not recover until the last quarter of 1959 when expansion of the British motor industry called for more production of tyres and automotive parts. During the intervening three years exports largely filled the order books of the machinery makers, but this excessive dependence upon overseas orders posed a fresh problem—there were fewer opportunities for trying out in the home market prototypes of improved machines. To preserve our exports, particularly to territories where there is local manufacture, we must keep ahead in design, in quality and in the adaptation of our machines to new processes, but what we offer must be well proven in service before it is sent overseas.

It is the considered view of the present writer that the best stimulus

PFFE PROGRESS

The uses of polytetrafluoroethylene are widening rapidly and a code of practice for its application has been issued by the British Plastics Federation. This is on the application of aqueous dispersions of PTFE to metals, ceramics and glass and although this is not, of course, the only way in which the material is used the code is likely to concern a large number of industries. These are as follows: chemical and oil, rubber, electrical and electronic, general engineering, aircraft engineering, paper making, textiles and food processing.

It is not intended that the code of practice should lay down rigid rules for the application of PTFE coatings, but that it should stress the points that are found to be desirable in practice. Brief details are given on the material, toxicity, handling precautions, surface preparation, processing, coating thicknesses and uses and properties.

Cabot Corporation

Effective from October 1 1960 Godfrey L. Cabot Inc. and its subsidiaries Cabot Carbon Company, Cabot Shops Inc., and Cabot Gasoline Corporation became a new organization to be known as Cabot Corporation.

Freeman's New Works

PRODUCTION began last month at the fine new works of William Freeman and Co. Ltd., who next year will celebrate their silver jubilee. Well known throughout the industry and to the general public as manufacturers of rubber and plastics products, the company, whose trade names have become household words, has used perhaps the best known for the new 'Suba-Seal' Works, which are at Staincross, Barnsley.

As fell as the famous range of hot water bottles marketed under this name, there is a whole range of baby feeding products and swim caps. The company also manufactures an extensive range of hospital nursing equipment in rubber and plastics materials. The 'Suba-Maid' trade mark covers a tremendous variety of household goods. Another trade mark, 'Free-Flex' covers blown polythene containers ranging from 2oz. to 5 gallons. The new works has an excellent laboratory for quality control of materials and finished products and also a research laboratory. Canteen facilities are provided, as are first aid and medical facilities.

The British Plastics Industry

MORE OPPORTUNITIES—MORE COMPETITION

By DAVID RADFORD

WORLD War II proved the period when plastics production in general took a tremendous step forward and, of course, in the post-war years advances have been stupendous.

In spite of the many advantages which the use of plastics could show, the traditional industries in general were reluctant to use them in their normal production arrangements, partly through inherent caution and partly through ignorance of the properties which the plastics materials possessed.

It has been said there are no bad plastics but only bad applications, and bad applications gave the industry a severe setback in the immediate post-war years.

Progressively, however, over the last decade obstructions to development have been largely but not entirely eliminated, and from a sales figure of 155,000 tons in 1950 the British plastics industry progressed to an output of 500,800 tons last year. This rate of increase is still being pursued.

Over the past few years the history of the various products known today can be commented on as follows:

Phenolics

The continued popularity of phenolic moulding materials is apt to be overlooked when contrasted with the glamorous progress of the newer thermoplastic materials. Nevertheless, over the years, steady and indeed, compared with many traditional materials, startling progress has been made, which can be instanced by the increase in phenolic materials from 65,400 tons in 1958 to 73,300 tons in 1959, an increase of almost 8,000 tons in one year. It is not envisaged, however, that phenolics will continue to make this progress, as they appear both in this country and in America to have settled down to a steady yearly consumption.

In general, their particular application is not likely to be overtaken by other plastics materials.

Aminoplastics

The popularity of aminoplastics continues to increase, the figures being 49,900 tons for 1958 and 54,600 tons for 1959.

Polyvinyl Chloride

The usage of PVC seems to be met by the present production capacity in this country but there is no doubt that installed plant can increase its production, and it would seem necessary for this to be done for sales rose by 15,000 tons in 1959 over the 1958 figure.

It is interesting to note that whilst by far the largest use is still for film and sheet, the cable industry is taking a more marked interest in the usage of this material.

Polythene

British capacity for the production of polythene is being rapidly increased, and a large rise in sales is forecast. This reflects world confidence in the continued increase in demand. Unfortunately, no official figures are published at present, so it is impossible to be factual about the progress this material has made, but a reasonable guess would be that sales increased in the United Kingdom by about 50% in 1959 over the 1958 figure. The largest use appears still to be in the production of injection mouldings, but the film and sheet manufacturers are rapidly catching up and may eventually surpass the requirements of the moulders.

Polypropylene

It is somewhat early to forecast what the future holds for this very interesting material. It seems that it may follow the usual pattern within the industry and not necessarily replace existing materials but rather find its market in additional uses of plastics by virtue of its especial properties, notably increased heat resistance.

Polystyrene

The consumption of polystyrene continues in an ever-increasing rise, consumption being 33,200 tons in 1958 to 39,300 tons in 1959. The large usage of this material today, of course, is in the toughened grades, including toughened sheet, the refrigeration industry probably being the largest user, closely followed by packaging, electrical and housewares.

Polyesters

After a somewhat slow start the reinforced plastics industry is now surging ahead, largely due to the lead given by the Reinforced Plastics Group of the British Plastics Federation, together with the research and development put in by the material manufacturers. The increase in polyesters from 4,700 tons in 1958 to 6,700 tons in 1959 shows quite clearly the interest which is now being taken in reinforced plastics by a multitude of user industries.

Mouldings

The increased use of compression mouldings is reflected in the rise in use of phenolics and aminoplastics as mentioned above, but the future of injection moulding appears very bright indeed.

Apart from the continued rise in

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the use of injection mouldings by all industries, many, such as the automobile, furniture, boat building and refrigeration industries, to name but a few, are expected in the future to employ mouldings of a size scarcely envisaged a few years ago. Already in this country moulders are using 200 and 300oz. capacity machines which are, of course, amongst the largest in the world. The development of larger mouldings places a heavy responsibility on the industrial designer to use both imagination and sound construction principles to utilize the increased properties and advantages to the maximum, a field which British Industry has as yet scarcely touched.

Greatly increased use of plastics mouldings, particularly blow mouldings, in the packaging field, can also be confidently expected in the near future.

Vacuum Forming

After a fairly good start the vacuum forming industry went through a period of consolidation, but the future is now much more certain and one can confidently anticipate an increased use of plastics sheeting in this field.

Extrusion

The extrusion manufacturer can produce everything from motor body trims to slide fasteners, and this means there is always likely to be a place for extrusion in the plastics field. The immediate future, however, is likely to see a considerable upsurge in the use of plastics piping, not only for cold water services and drainage but in the manufacture of chemical plant, and here it will reflect the high rate of growth of our chemical industry as a whole.

Additionally, of course, the industry can look forward to an increased use of plastics materials in the building industry, notably in the form of rainwater goods.

Italy has probably given the world the lead in this field but the British building industry is now very much alive to these materials.

General Fabrication

It is quite impossible in a few words to cover the whole field of fabrication from semi-processed materials such as sheet, rod and tube, but suffice it to say that this section of the industry is making as much progress as the rest. Especial mention, however, should be made of the increasing popularity of dipping, the fabrication of large structures from thermoplastic sheet (*i.e.* ventilation systems for chemical plants) and the thermoshaping of sheet for specialized purposes. In this field acrylics are greatly to the fore.

Laminates

The laminated material manufacturers' progress is no exception in the general state of the industry, and apart from the ever-increasing use of industrial laminates in the electrical field, *i.e.* printed circuits, the decorative laminate has now most definitely come into its own.

Plastics Machinery

The engineering section of the industry can now produce all the requirements of the British manufacturer. This group appears to be working to capacity, which reflects the industry's confidence in its own generally continued expansion.

Exports

Increased home sales made the largest contribution in 1959, but exports rose sharply to 28% higher than the previous year. This rise is considered satisfactory, but one must not overlook the advent of the Common Market and the European Free Trade area, since their arrival will certainly bring increased competition, but at the same time increased opportunities, and a vigorous export drive through the coming years is essential to our prosperity.

We must not overlook the market potential which exists in Eastern Europe, and this country must forge ahead in this particular field. If the present opportunity is neglected other countries will step in and secure the prizes.

In general may I once again exhort the plastics industry through its entirety at all times to maintain quality as its watchword, and ask the moulders, fabricators and all those concerned to see that plastics are only applied in their proper sphere, knowing that their performance, when properly applied, is second to none.

Angus Solve Hose Problem

FIRST TO OVERCOME TWIST

THE tendency to twist under pressure is a fundamental characteristic of wrapped ply hoses. As a result of considerable research and development work, George Angus and Co. Ltd. have evolved a manufacturing technique which is wholly successful in this. In fact, the firm guarantee that, not only will their entire range of first aid hoses comply with the specified requirements, but that they will substantially exceed them.

JCDD. 7 lays down that first aid hose must not develop a twist of more than two turns in a 60ft. length when subjected to an internal pressure of 150psi. While this requirement relates only to the $\frac{3}{4}$in. x 4 ply size, Angus have taken the specification seriously enough to believe that it is sufficiently important to the user for him to welcome its application to the whole range of sizes now available.

The company states, 'We do not expect a total twist of more than a quarter of a turn in a 60ft. length of any diameter at working pressure and half a turn at double working pressure. So far as we are aware, this is the first time that a wrapped ply delivery hose has been produced with such a performance.'

The new method of construction does not entail the use of opposing yarns so that there is no reduction in bursting pressure; indeed, this tends to be enhanced because the yarns are quite free to assume the position in which they can take the maximum strain.

Monsanto Canada Acquisition

The purchase of Robinson Foams Ltd., manufacturers of polyurethane foams, has been announced by Leo E. Ryan, president of Monsanto Canada Ltd.

Mr Ryan said that the acquisition of Robinson Foams Ltd. by Monsanto was a natural step for the company to make, because of its extensive interests as a leading plastic supplier to the Canadian plastics industry.

E. D. Moffat has been elected president of Robinson Foam Company and the following directors have been appointed: Leo E. Ryan, A. Monsaroff and W. W. Robinson.

Kay at Full Stretch

Round-the-clock shift working has just been introduced by Kay Brothers Plastics Ltd. of Marple, Cheshire, producers of Foamoprene expanded polyurethane foam for the car and upholstery trades.

New cutting and adhering plant has been installed at the Marple factory, which produces as much foam now in a fortnight as it did in a year in 1955.

Boat made from laminated expanded Royalite ABS sheet, showing vacuum-formed one-piece deck and cockpit construction

ABS Resins

TOUGH, VERSATILE FABRICATING MATERIAL

By J. S. WILKIE

ABS resins are a development from the manufacture of synthetic rubbers and have been available in the United States since the latter part of the last war. It is only from 1956 that they have been used in any quantity in the United Kingdom and this article is a review of the progress since then.

The manufacture of rigid sheet and vacuum forming has been successfully developed by the North British Rubber Co. under the name 'Royalite,' while resins for injection moulding and extrusion are being marketed by Anchor Chemical Co. (Cycolac) and Imperial Chemical Industries, Plastics Division (Kralastic).

These materials are formulated from the three monomers, acrylonitrile, butadiene and styrene. Basically they are composed of resins made from styrene and acrylonitrile, modified with butadiene acrylonitrile rubbers. Historically the first patents appeared about 1943 covering copolymers of styrene and butadiene, where the styrene was the major component. These can be considered as the origins of this technology. Styrene butadiene resins were modified with butadiene-styrene rubbers and, in addition, required vulcanization to develop their full mechanical properties. They suffered from low heat distortion and lack of oil resistance. The next major development was to replace the butadiene-styrene type rubbers with butadiene-acrylonitrile rubbers and omission of the vulcanization operation. Such resin-rubber compositions showed some improvement in mechanical and thermal properties, but the introduction of styrene-acrylonitrile resins about 1948 gave much improved thermal and oil resistant properties. From this date the main improvements have been in the processability of the resins and their mixtures.

Manufacture and Properties

The resins and rubbers are manufactured by emulsion polymerization methods and their latices can be blended before coagulation or the coagulated rubber and resin blended in an internal mixer as a separate operation. Full development of mechanical properties depends on proper dispersion of the rubber in the resin phase. A later development has been to produce graft polymers where the resin is polymerized in the presence of the rubber.

It has been found that there are limits to the composition of the resins and rubbers which will give the optimum properties of high impact, high heat distortion and dimensional stability, combined with good low temperature properties. The acrylonitrile content of the rubber should be between 10 and 30% and, in the case of the resin, it also should be between 10 and 30%. Lowering the acrylonitrile content of the rubber improves the low temperature toughness of the rubber resin blend, while increasing the acrylonitrile content of the resin improves the low temperature properties of the resin. As these materials are basically mixtures, their physical properties, especially impact, depend on the degree of dispersion of the rubber in the resin.

Energy Absorption

It has been found by microscopic examination that the rubber is present, dispersed in the resin as discrete particles. It appears that the good resistance to mechanical shock shown by ABS polymers is due to the ability of the rubber particles to absorb energy by their elongation across a crack. Thus a portion of the shock energy is dissipated in the elongation and breaking of these rubber particles or, if not actually breaking them, causing them to be plucked from the one face of the break.

From the various rubber and resin compositions available, within the limits given above, it is possible to produce a considerable number of mixtures. For practical purposes, it has been found that they fall within certain groups, classified by their impact properties. The properties of these groups are summarized in Table 1, along with the properties of an unmodified resin.

It is seen that the unmodified resin,

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Table 1

TYPICAL PHYSICAL PROPERTIES OF ABS POLYMERS

	Unmodified styrene acrylonitrile resin	Medium impact ABS polymer	High impact ABS polymer	Very high impact ABS polymer	Low temperature impact ABS polymer	Heat resistant impact ABS polymer
Izod impact notched ¼-in. bar at 73°F., ft. lb./in.	0.4-0.6	0.5-2.0	2-6	5-9	6-10	4-7
Izod impact notched ¼-in. bar at —40°F., ft. lb./in.	0.4-0.6	0.4	0.5-1.5	0.6-1.5	1-3	0.5-1.0
Elongation at break, %	2-3	5-20	20-100	20-50	30-200	10-30
Tensile strength, lb./sq. in.	10,500	6,500-8,500	4,500-7,500	4,000-6,000	3,000-4,000	8,000-9,000
Flexural strength, lb./sq. in.	16,000	11,000-12,500	7,000-11,500	7,000-8,000	3,000-4,000	11,500-12,500
Rockwell hardness, R scale	121	108-118	85-115	90-100	30-65	112-116
Heat distortion temperature (264 lb./sq. in load), °F.	208	190-205	185-200	180-185	160-170	225

while showing good tensile and flexural strength, has poor impact and elongation at break. The modification of the resin by the addition of a nitrile rubber gives improved impact resistance at the expense of some loss in tensile and flexural strength. Likewise, the hardness shows a reduction. It should be noted that improvement in impact properties causes a progressive reduction in the heat distortion temperature, which is due to the amount and type of rubber necessary to give the improvement. In addition, these ABS resin mixtures show good resistance to dilute acids, alkalis and aliphatic organic liquids except ketones, esters and chlorinated solvents. In fact, products made from ABS resins can be washed in light petroleum naphtha without any ill effect. Table 2 shows percentage change in weight of samples totally immersed in various acids and alkalis at the given concentrations. Extensive trials have shown that ABS resins do not show staining when in contact with fruit juices, butter, fats,

Table 2

EFFECT OF TOTAL IMMERSION FOR SEVEN DAYS AT 72°F.

	% change in weight
Water	0.57
Hydrochloric acid, 10%	0.61
Hydrochloric acid, 38%	1.41
Sulphuric acid, 10%	0.56
Sulphuric acid, 45%	−0.01
Phosphoric acid, 85%	−0.05
Nitric acid, 10%	0.57
Caustic soda, 10%	0.48
Caustic soda, 50%	−0.03
Ammonium hydroxide, 28%	1.14
Sodium carbonate, 10%	0.57
Ferric sulphate, 10%	0.58
Petrol	3.43

meat, etc. This has led to the use of trays and bins made from ABS polymers in the catering and food processing industries. These articles can be heat sterilized, without loss of dimensional stability, up to 250°F. in steam, provided the period of immersion is not prolonged beyond normal sterilizing periods.

The heat distortion temperature of an ABS resin does not change greatly with increasing stress and when tested in accordance with ASTM D-648-45T at 66 psi and 264 psi, the temperature of distortion does not change by more than about 15°F. A further point illustrating dimensional stability over a relatively wide range of temperatures is shown in Figs. 1 and 2, where the tensile creep under constant load at 73°F. and 160°F. up to 1,000 hrs. is given. These results show that little move-

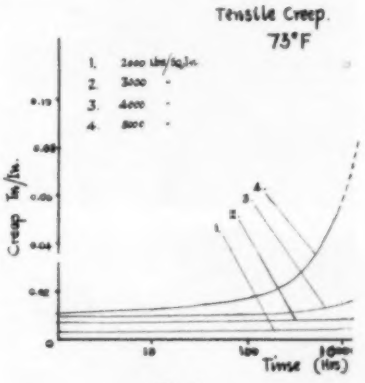


Fig. 1

ment takes place up to 3,000 psi stress at 73°F., while, at the higher temperature, there is negligible creep up to 1,000 psi stress.

Ageing

It has been found that the best results on outdoor applications have been given with black pigmented materials. Weathering of ABS resins produces a series of minute surface cracks which sometimes look like a bloom and reduce the impact resistance of the product. If the weathered surface is machined off, then there is almost full recovery of the impact properties. Fig. 3 shows the effect of weathering on the unnotched impact of a black and a grey compound of the same stock. The figure for the unaged normal notched test is given for comparison. The grey stock shows a steep drop with a levelling out after about 12 months. This is characteristic of non-black compounds and for this reason black is the recommended colour for continuous exposure out-door applications.

Processing

ABS resins can be handled in conventional thermoplastic processes,

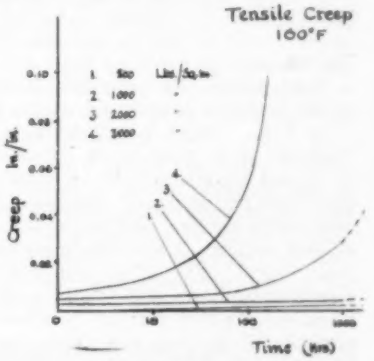


Fig. 2

i.e. injection moulding, extrusion, calendering, etc. The material in chip form tends to absorb moisture which must be dried off before ex-

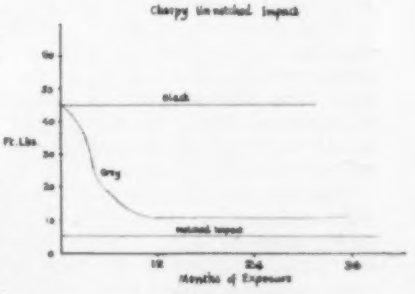


Fig. 3

trusion or injection moulding, to prevent blistering.

Injection Moulding

Because of the high loading of rubber, these resins keep their stiffness or body at elevated temperatures, causing more die drag than with other thermoplastic materials. This pre-

vents the attaining of a high gloss finish. To reduce this disadvantage, use should be made of highly polished or plated moulds and dies. Being a tougher stock at ejection temperature, there are less breakages on ejection and shallow threads and undercuts can often be stripped unharmed. For moulding, the cylinder temperature should be between 325°F. and 425°F., although higher temperatures can be used with a fast throughput. Mould temperatures can be between 100°F. and 200°F., the higher the temperature the better the surface finish. Injection pressures can be from 6,000-30,000lb./sq.in. — one should use the highest possible pressures to reduce temperature of stock. Gates and runners should be larger than those for polystyrene and as short as possible to reduce cooling times. Good dimensional stability and low distortion on cooling are characteristics of mouldings in ABS resins.

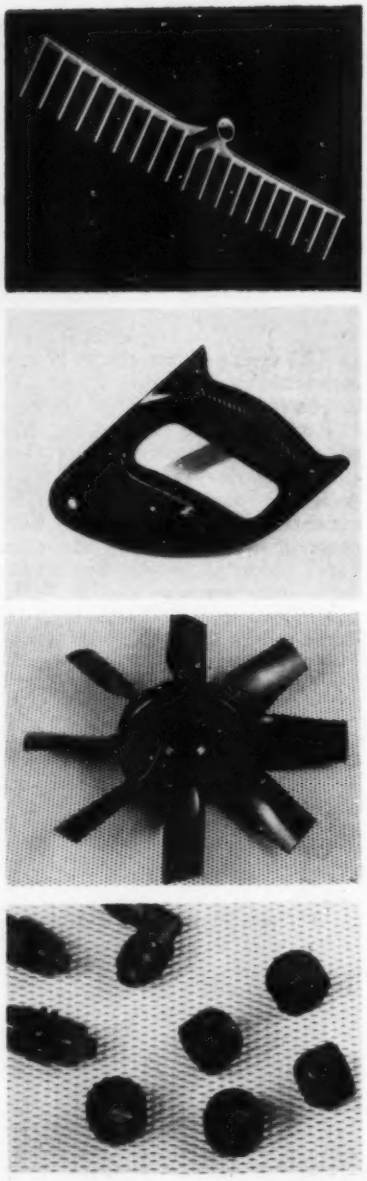
Extrusion

Best results are obtained with screws giving a compression ratio of 3 or 4 in 1 with a shallow flight. Polished dies give better surface finish and straight through die-heads give best performance. Dimensions of products are held well during take-off and cooling. Barrel temperatures from 350°F. and 425°F. with a die temperature of 400-450°F. are found to give best results. Standard methods of shaping pipe, etc., can be applied to ABS resins. Injection moulding and extrusion scrap can be chipped and blended with fresh stock without loss in properties.

Calendering

Calendering into sheet can be done on a conventional plastics calender at temperatures up to 400°F. The sheet can be press-laminated and embossed with a suitable grain or design. The embossing can be made permanent so that if the sheet is reheated to processing temperature, it will not lose the pattern.

The raw material cost of ABS resins is above that for other thermoplastic materials, such as polystyrene and rigid PVC. For this reason most applications are found where full use can be made of the mechanical, thermal and low temperature properties of ABS resins, *i.e.* where structural and decorative properties can be combined. A typical example has been the use of extruded pipe and injection moulded fittings for the chemical and oil industry, where advantage can be taken of the corrosion resisting properties at elevated temperatures.



A range of typical ABS mouldings: Garden rake, saw handle moulded in two halves and solvent welded, air-conditioning impeller and hose coupling locking nuts

Pipe is sufficiently tough to be threaded at the ends to fit a threaded connexion, but excellent results have been obtained using cement with a tapered connexion to give an interference fit. This is generally referred to as solvent welding and the cement used is generally a solution of ABS resin in solvent. Typical applications have been in the carrying of crude oil at 125°F. and a pressure of 50lb./sq.in., and natural gas at 50lb./sq.in. In the chemical industry, chlorine gas and dilute sulphuric at 140°F. have been successfully carried in ABS pipe. Due to the smoother inside walls of such piping compared with cast metal pipes, there has also been a reduction in pressure loss during pumping. This solvent welding technique can also be used to produce a hollow article which would normally have to be solid. The high-impact strength and resistance and other good mechanical properties make possible products which can stand up to rough handling such as the saw handle illustrated. ABS resins have made possible entry into fields normally associated with metal, with a saving in weight. Examples are air-conditioning impellers, roller-skate wheels and rake heads.

Vacuum Forming

As mentioned previously, it is possible to vacuum-form embossed or smooth sheet. When heated to forming temperatures, sheets still have a fair amount of mechanical strength, which makes possible deep draws with fairly regular wall thicknesses, using the various standard techniques. Products formed from sheet which combine strength and finish, have found a ready use in the automobile industry. Examples are dashboard covers, instrument housings, glove boxes, interior door-panels and wheel arch covers. A recent development has been light-weight luggage in leather-embossed sheet.

It is now possible to make laminated sheet consisting of a core of expanded ABS resin with solid outer layers. Using this sheet, boat hulls and deckings have been vacuum moulded to produce dinghies and runabouts up to 14ft. These hulls have shown outstanding resistance to impact, boats having been crashed at speed into floating oil drums with no serious damage. The cellular construction gives buoyancy, making the boat almost unsinkable and, in the case of powered boats, helps to damp out engine noise. Wood reinforcing is used internally and on the transom for the engine mounting. No painting is required as the colour is incorporated in the outer skin of the laminated sheet and also complete protection from corrosion and staining from oil scum is achieved. This is a product making use of all the properties of ABS resins.

Acknowledgment is made to the North British Rubber Co. for permission to publish this article and to the following companies for the use of illustrations: Airscrew and Jicwood Ltd., Hazelock Ltd., A. B. Plastikmanufaktur, Sweden, and A. B. Hammaplast, Sweden.

Nitrile Rubbers and Latices

RECENT DEVELOPMENTS AND CURRENT USES

By S. MOTTRAM

IT may be with some surprise that one realizes that nitrile rubbers have been commercially available for 25 years. Their consumption has grown steadily after the inevitable lag following their introduction in 1934.

Consumption is still rising and production has now commenced, or is about to commence, in eight countries outside the Russian *Bloc*, namely USA, Canada, Great Britain, Germany, France, Italy, Holland and Japan.

The commercial application of nitrile rubbers now falls into two clearly defined fields. Whilst solid rubbers achieved their place in industry because of excellent oil and petrol resistance, the nitrile rubber latices are finding uses where this particular property is of no significance.

Solid Rubbers

Commercially, these rubbers are available with acrylonitrile contents ranging from 18-45%; as a broad generalization, they are manufactured by the so-called hot or cold polymerization techniques. In general the latter method gives rubbers with easier processing properties.

In looking at these rubbers we shall consider firstly, what are their advantages and disadvantages as materials for industry, and secondly, what have been the recent developments in their uses.

Advantages

1. Excellent oil and solvent resistance.
2. High abrasion resistance.
3. High adhesive strength.
4. Good mechanical properties.
5. Good heat resistance.
6. Low air and gas permeability.

Disadvantages

1. Limited low temperature flexibility, particularly the high acrylonitrile types.
2. Limited ozone resistance.
3. Moderate to poor electrical properties.
4. Limited resilience.

This is not the full story, as it is possible to modify some properties in order to overcome inherent defects in a nitrile rubber-containing composition. A good example of this is ozone resistance, since by blending a nitrile rubber with a small percentage of PVC, it is possible to achieve a large gain in resistance to ozone and sunlight without loss of rubberlike properties.

Work on stressed samples aged in direct light clearly shows the improvements possible even with small proportions of PVC (Table 1).

Table 1

Nitrile rubber (Hycar 1042)	100	90
PVC (Geon 113)	—	14.3
Ferroclere 1825	—	0.2
Zinc oxide ..	5	5
SRF black ..	40	40
Sulphur ..	1.5	1.5
TMS	0.5	0.5
Exposure conditions	Outdoor weathering—$\frac{1}{8}$in. sheet bent round a 1.25in. mandrel	
Result	Cracked after 21 days	No cracking after 300 days

Present uses of nitrile rubbers cover a wide field based on the first three properties listed in the table of advantages.

Oil and Petrol Resistance

A major outlet for solid rubbers is still in the field of articles required to resist oil and petrol, *e.g.* in the manufacture of O-rings, U-rings, grommets, etc., whether or not they are bonded to metal. Apart from oil or petrol resistance, other properties demanded are low creep, good high temperature resistance and good abrasion resistance, as in the case of rotary seals.

Nitrile rubbers are called for in the manufacture of hose when oil and petrol resistance is required, and by suitable textile or wire reinforcement, high pressure requirements may be met.

During the war extensive use was made of nitrile rubbers in the development of flexible fuel tanks which gave an added safety feature in that they were tough enough not to burst in the crash landing of aircraft, thus minimizing the risk of fire. Nowadays these tanks are standard fittings in aircraft and the 'Britannia' is fitted with 20 such tanks, holding some 30 tons of fuel.

A more recent application of this principle is in the development of large sausage-like containers (Dracones) which can be towed readily by many types of seagoing craft, and can be manufactured in sizes up to 400ft. long and 15ft. in diameter,

Non-woven fabric made with nitrile rubber latex is used for the interlining of this half-finished dress made by Bondina Ltd.

holding approximately 270,000 gallons of fuel.

Abrasion Resistance

Whilst this property is difficult to assess, experience has shown that nitrile rubbers have excellent abrasion resistance.

Textile spinning cots provide an example of the need for a combination of several different properties. Good abrasion and oil resistance are required but anti-static qualities are also needed to handle textile fibres. Due to the relatively poor electrical properties of the nitrile rubbers, these can be obtained without undue difficulty.

In the manufacture of brake linings the use of nitrile rubbers is increasing as it leads to improved properties such as less 'fade' and freedom from brittleness.

A newer application is in the production of highly abrasion resistant top pieces (heels) to meet the severe demands made by the change in ladies' shoe fashions which at present calls for smaller and smaller heels. With a 9 stone body weight, loadings as high as 800 psi can be met with on the smallest heel tips. A typical formulation is as follows: —

Medium-high nitrile rubber (Hycar 1002)	100
Modified phenolic (Cellobond H. 831)	40
Aluminium silicate	75
Zinc oxide	5
Stearic acid	1.5
Sulphur	1.5
MBTS	1.5
TMS	0.25

Latices

It is in this direction that interesting and rapidly growing outlets exist.

Latices can be produced covering a wide range of acrylonitrile contents, but the main commercial range lies in the 25-40%. Two broad types are now available, namely the simple butadiene/acrylonitrile rubber latices and newer formulations containing carboxylic acid groups.

This latter type is designed to overcome one of the major disadvantages of the nitrile rubbers in that after curing, either with normal sulphur/accelerator systems or with zinc oxide only, products with very high tensile strength values are obtained from these latices.

CARBOXYLIC MODIFIED NITRILE RUBBER LATEX (HYCAR 1571)

	Zinc Oxide Cure	Sulphur/ Accelerator Cure
Cure: 20 min. at 120°C.		
Tensile (psi)	2,115	3,150
Elongation at break (%)	860	570

Unmodified nitrile rubber latices will give values of the order of 200-300lb. per sq. in.

Paper Treatment

Nitrile rubber latices are used with paper to provide one or more of the following properties: grease and oil resistance, increased wet strength, greater elongation or extensibility, improved edge tear, higher burst strength, improved resistance to water or chemical attack, improved heat resistance.

There are two ways in which nitrile rubber latices are used in paper treatment.

Beater additions. Nitrile rubber latices are added to the pulp at the beater stage, coagulation of the latex being possible with alum. Pick-up varies between 10 and 40% and the process yields dense tough paper suitable for gaskets.

Saturation. Suitably designed papers are required for saturation and a wide variety of papers can be produced. This type of paper is used as a tough backing for pressure sensitive tapes, and in heavier gauges, gives flexible papers with high tear strength and good fold endurance. Coating of these papers with PVC is common.

THE AUTHOR

STANLEY MOTTRAM, A.I.R.I., was born in China in 1912 *and came to the UK in* 1920. *For a number of years he was employed at the Rubber Service laboratories of I.C.I. working on varied problems connected with rubber chemicals and synthetic rubber. During this period* (1938) *he obtained the Associateship of the Institute of the Rubber Industry. In* 1949 *he joined British Geon Ltd. and has since been concerned with Technical Service on both Geon PVC and Hycar synthetic rubbers.*

Nitrile rubber gloves made by the Dunlop Rubber Co. Ltd. are oil resistant, hard wearing and impervious to liquids

Leather Treatment

Nitrile rubber latices have excellent pigment binding properties and are extensively used for the production of tough, rub-fast finishes for leather. Good adhesion to leather is also a feature of nitrile rubber latices.

Protective Gloves

The coating of textile-based gloves with carboxylic modified nitrile rubber latices, produces industrial gloves having excellent petrol and oil resistance, coupled with good resistance to cuts, tears and abrasion.

The technique employed follows normal rubber latex practices. The cotton glove on a former is dipped into a solution of alum and then immersed in the latex bath using a zinc oxide curing system and suitable proportion of thickener (methyl cellulose). Drying is carried out at 60-80°C., followed by the final cure at 140°C.

A typical formulation is as follows: —

	Wet Weight	Dry Weight
Latex (Hycar 1571) ..	250	100
Zinc oxide dispersion (50% solids) ..	18	9
Thickener (Celacol M20) (5% solids)	20	1

Nitrile rubber latices suitably compounded are proving of interest in many adhesive applications. When blended with 20% borated casein, good adhesion between PVC and rayon, nylon and paper can be achieved.

Tar Blends

Solid nitrile rubbers have been used in tar blends to give resistance to attack by various fuels for airfield runways, garage floors, etc. Generally their use has been restricted to expansion joints. In place of solid rubbers, latices may be added to the molten tar. Because of the small particle size, good dispersion in the tar blend is readily achieved. Apart from fuel resistance, improvements are obtained in the softening point

of such compositions, giving advantages under hot weather conditions.

Textiles

A number of interesting applications have arisen in connexion with the textile industry. Superior printing inks can be prepared by the inclusion of a nitrile rubber latex, giving much improved fastness against wet or dry rubbing. In the manufacture of cloths which must be hard wearing and durable, for example 'denims,' a tremendous improvement in abrasion resistance can be obtained by the use of nitrile rubber latices, either by warp sizing or direct padding of the cloth. Pick-up weights of the order of 5-8% are recommended.

Limitations exist in that such materials are not recommended where a maximum degree of whiteness is required.

Typical physical test data obtained on a drill fabric approximately 9oz. per sq. yd. are as follows:—

Treatment	Abrasion Losses	
	Nitrile rubber latex size (Hycar 1562)	Starch size
Initial	4.7 mg.	7.5 mg.
After 5 washes	5.1 mg.	10.2 mg.

The abrasion loss was measured after 1,000 revolutions by a rotating abrasive cylinder both before and after washing in a ½% soap solution at 40°C., each washing lasting 30 minutes.

Good crease resistance is a feature of this type of system but improvements can be obtained if about 10% of a melamine resin is incorporated. This resin also improves the rate of cure of the nitrile rubber latex.

Heat sensitized systems may be necessary where thick fabrics are required as there is a tendency for some migration of the rubber phase to the surface during the drying stage.

Crease Resistant Finishes

Nitrile rubber latices may be used in conjunction with amino-resins to give crease-resistant finishes. The advantages are in better handle, greater tear strength and a lower pick-up for equivalent crease resistant properties.

A typical formulation is as follows:—

	Dry Weight	Wet Weight
Nitrile rubber latex (Hycar 1571)	70	175
Amino Resin (Beetle BT. 309)	30	33.4
Resin Catalyst (Catalyst AC)	1.5	1.5
Wetting agent (Manoxol OT)	10	10
Water	To 10-20% total solids	

Contrasting uses of nitrile rubbers. The hoses, easy to handle and inexpensive to maintain, dispense some half-million gallons of oil and petroleum daily. Tough, resilient, 50-gal. drums made from rayon, coated and impregnated with Hycar, withstand violent shocks and can be folded when not in use

With blends of nitrile rubber latex and amino resins the pH of the bath is important and should be between 6 and 7 when using urea-formaldehyde resins but about 7.5 with melamine-formaldehyde resins. These are minimum values, but if the pH is too high, difficulties may be experienced in curing the resin. Anionic or non-ionic stabilizers may be used but the use of soaps such as potassium oleate should be avoided as they tend to retard the cure of the resin.

The water in the formulation is used to dilute the resin before addition to the latex. The catalyst is added immediately before the bath is required. The treated fabric is first dried and then cured at 130-160°C., the temperature being dependent on the type of resin used.

After cure the fabric is washed in order to remove excess resin and unwanted reaction products. A suitable washing solution is, soap 2 parts, sodium carbonate 1 part, water 1,000 parts.

Non-woven Fabrics

This branch of the textile industry is probably the largest single consumer of nitrile rubber latices. A wide range of these fabrics is now produced varying according to weight, type of fibre, orientation of the fibres and the nature of the binder.

The fibres in common use are cotton, rayon and nylon. These may be formed parallel to one another, cross laid or randomly distributed. The stages in the production of non-woven fabrics are, opening of the compressed fibre bales, web formation, application of the binder, drying and curing of the binder. Much of the equipment used is conventional textile equipment; specialized equipment is concerned mainly with the production of randomly distributed fibre webs and the application of the binder.

The binder may be applied by saturation followed by suitable squeeze rolls, by spraying or by roller coating. A carboxylic-modified nitrile rubber latex is preferred because it confers good resistance to dry cleaning fluids and gives superior tensile strength properties compared with a conventional nitrile rubber latex.

Crease resistant properties are improved by the incorporation of thermosetting resins, of which about 10% on the weight of rubber is employed.

Typical systems are as follows:—

	Dry Weight (1)	(2)
Nitrile rubber latex (Hycar 1571)	100	90
Zinc oxide	2	—
Sulphur	2	—
Accelerator (Vulcafor ZDC)	2	—
Resin (Beetle BT. 309)	—	10
Catalyst (AC)	—	4
Water	To 10-20% total solids	

Very thick fabrics may exhibit delamination as a result of migration of the binder with the water during drying, and it is advisable to use a heat-sensitized system.

Acknowledgment

The author is indebted to the Directors of British Geon for permission to publish this article.

EFTA and the British Plastics Industry

By C. J. G. STANLEY

ON July 1 1960, the European Free Trade Association (EFTA) came into being and there has since been much discussion regarding the development of the two trading areas of Western Europe and the relationship between them. During the summer misgivings were openly expressed by the other six members of EFTA in regard to UK's intentions towards her partners in the Association, and her possible attitude to the European Economic Community (EEC). It is to be hoped that UK ministerial announcements shortly before the summer recess have finally set at rest these misgivings. The attitude of the plastics industry in the UK has throughout been to seek a wider measure of free trade in Europe, or for that matter over a wider area of the world if opportunity offers.

THE AUTHOR

C. J. G. STANLEY, general manager of the British Plastics Federation, was educated at Eton and St. John's College, Cambridge, where he read Natural Sciences and became captain of Lady Margaret Boat Club. He served in the ranks of the Royal Tank Regiment for two and a half years before being commissioned in the Royal Armoured Corps in 1942. He joined the Federation in 1947 and has been senior executive since 1956. He was secretary to the Plastics Moulding Productivity team which visited the USA in 1952 and represents the Federation on some FBI committees. He went to Stockholm last year as one of the industrial advisers on behalf of the plastics industry to the group of trade experts negotiating the Stockholm Convention.

After the breakdown of the previous free trade area discussions in OEEC the formation of the outer seven grouping was a natural development. It is no disrespect to our partners in that enterprise to admit that the EFTA, as at present constituted, is a second best to the original wider conception of a free trade area embracing all, or nearly all, the countries of OEEC. This is true for each of the other countries of EFTA just as much as it is for the UK.

Table 1 shows the total European trade of EFTA countries in 1958.

The formation of the EFTA is, however, a definite step in the right direction, and is one that is welcomed by the British Plastics Federation and the industry it represents. This industry intends to do all in its power to foster and develop the Association, whilst still looking forward to the day when some arrangement between the EFTA and EEC becomes possible.

THE CONVENTION

Much has been published about the treaty establishing the European Free Trade Association, the Stockholm Convention, but some of its provisions and particularly those of the attached schedules are complicated. It is perhaps not surprising therefore that it is still not widely understood in industry, particularly amongst the smaller firms who cannot spare a member of their staff to devote a considerable portion of his time to mastering its intricacies. These firms would be well advised to take their problems of interpretation and application of the Convention to their trade association. Many trade associations in the UK, the British Plastics Federation amongst them, assisted directly in the negotiation of the Convention by the provision of expert advisers to the UK delegation in Stockholm. They are thus well placed to advise their members on this subject.

In spite of all that has been written on the subject already it would perhaps be well to outline once again the main features of the Convention: these are as follows:

Territorial Area

The territories at present included are Austria, Denmark, Norway, Portugal, Sweden, Switzerland, the United Kingdom and the European territories for whose international relations those countries are responsible with the exception of the Faroes, Greenland, Gibraltar and Malta.

Aims

The principal aims set out in the Convention are to establish free trade within this area in conditions of fair competition and to promote a sustained expansion of economic activity, full employment, increasing productivity, financial stability, continuous improvement of living standards and the rational use of resources.

There is an important subsidiary aim which is 'to contribute to the harmonious development and expansion of world trade and to the progressive removal of barriers to it.' This sentence gives a clear indication of the future hope of the Association that it will be able to broaden the field over which its principles operate, and in particular that some arrangement can in due course be reached with EEC.

Method

The main provisions of the treaty are aimed at the removal of impedi-

Table 1
Total European Trade of European Free Trade Association Countries for 1958

A—Exports (£m)

Exporter	Importers: Rest of EFTA	EEC	OEEC
Austria ..	33	158	197
Denmark ..	180	140	327
Norway ..	107	76	187
Portugal ..	22	28	51
Sweden	275	250	536
Switzerland ..	94	211	310
United Kingdom	373	420	937
Total EFTA ..	1,084	1,283	2,545

B—Imports (£m)

Austria ..	43	208	256
Denmark ..	189	173	363
Norway ..	177	165	344
Portugal ..	37	67	105
Sweden	207	353	563
Switzerland ..	66	359	428
United Kingdom	367	534	1,027
Total EFTA ..	1,086	1,859	3,086

ments to trade especially the elimination of Customs duties and quota restrictions between the seven member states of the Association by January 1 1970. A transitional period from July 1 1960 to January 1 1970 has been chosen in part to give the industries of the member states adequate time to adjust themselves to the changing circumstances, but primarily to coincide with the timetable for the EEC in accordance with the Treaty of Rome.

Tariff reductions are provided for as follows (percentages relate to base date tariff*):

July 1	1960	reduction to	80%
Jan. 1	1962	„ „	70%
July 1	1963	„ „	60%
Jan. 1	1965	„ „	50%
Jan. 1	1966	„ „	40%

thereafter by 10% per annum.

Special provisions made for Portugal in view of her lower level of development allow her transitional period to be extended to 1980, with the exception that the normal timetable applies to Portuguese goods in which total exports are 15% or more of production and also to any other goods to which she notifies the Council of the EFTA that it shall apply. Portugal has already put some plastics materials on her notified list.

Portugal is also entitled to increase her duties before July 1 1972 where necessary to enable her to promote development of a specific item provided that any such duty does not exceed the normal *ad valorem* duty applied to similar products from other countries on a MFN basis and provided also that the additional duty is eliminated with the others by 1980.

The above timetable is that in force at the time of writing, but with the acceptance by EEC of the modified Hallstein plan for accelerating the timetable of the Treaty of Rome this programme would get out of step with EEC on January 1 next unless it is modified by the EFTA Council before that date. Although there would not appear to be any necessity for the two groups to keep in step now that they are marching in opposite directions the EFTA countries have throughout shown a tendency to tailor their own plans to fit those of the Common Market as far as practicable in order to facilitate an arrangement with EEC at an opportune moment. There has also been evidence of a desire to move faster through the transitional period. These considerations suggest that an acceleration of the EFTA timetable to fit that of the modified Hallstein plan is a reasonable expectation.

The progressive elimination of quantitative restrictions on specific imports from other members of the Association is also provided for and follows broadly the same timetable as the tariff reductions. Ignoring minor complications this amounts to an increase each year in the quota figure of 20% of the effective quota of the preceding year.

Rules of Origin

The EFTA unlike the EEC, leaves its members freedom of action in matters of commercial policy towards countries outside the Association and thus enables its members each to levy its own tariffs on imports from the rest of the world. In such circumstances there could be a serious deflection of trade via the lower tariff members unless regulations were incorporated in the Convention to ensure that only those goods genuinely originating within the area are accepted for area tariff treatment. This involves drawing arbitrary lines as to what constitutes an area product and this has been done in the Convention in the schedules dealing with 'area origin.' The rules of origin are complicated and their implementation is not proving easy, but in essence there are three alternative criteria for assessing the origin of any goods.† These are:

1. Goods wholly produced within the area.
2. The added value rule (or percentage criterion).
3. The process rules.

1. Goods wholly produced within the area

This definition of origin means precisely what it says and should be used with great care. It is useful primarily for products extracted from the ground within the area but can be used for manufactured goods if they have been made from materials containing no element imported from outside the area or whose origin is undetermined, and it may be of interest to note that all scrap and waste *resulting from manufacturing operations within the area* is classed as 'wholly produced' in the area.

2. The added value rule (or percentage criterion)

This definition requires proof that the goods have been manufactured within the area and that the value of any materials imported from outside the area or of uncertified origin does not exceed 50% of the fob export price of the goods.

The basic materials list may be used in conjunction with this rule. This is an agreed list of basic raw materials which are not available within the area, or not so available in any significant quantity. These materials in the forms described in the list may be regarded as containing no element imported from outside the area for the purposes of the added value rule when, and only when, they are used in a manufacturing process within the area.

3. The process rules

These require that the goods shall have been made in the area by a specific process. Process rules have been agreed for the great majority of items in the Brussels Nomenclature which are the subject of the general provisions of the Stockholm Convention and many of these are very simple. Regrettably this is not true of the plastics items in Chapter 39 of the Brussels Nomenclature for which the process rules are complex. This is in part due to some hard bargaining during the negotiations, but is mainly caused by the complexity of the products themselves and the raw materials from which they are made, coupled with the variety of the processing methods available.

The British Plastics Federation has been continuously and closely concerned with the problems of the process rules for Chapter 39 products from their initial evaluation some two years ago, in co-operation with the Association of British Chemical Manufacturers, to the present day problems of the practical application of these rules to commercial operations in the export field.

Application of the Origin Rules

The origin rules are operated in practice by a system of certification which has been agreed by the Customs authorities of the seven nations comprising the Association. Goods crossing a frontier within the area, and for which area tariff treatment is claimed, must be accompanied by a certificate of origin in the prescribed form. These certificates have been kept reasonably simple and may be executed by various bodies, such as chambers of commerce, who have been duly authorized by their own governments to act in this capacity. They may also be executed by the last manufacturer of the goods himself if he is also the exporter.

The latter course is clearly the best

**The base date tariff is in most cases the duty in operation at Jan. 1, 1960, except in the case of Denmark where it is Mar. 1, 1960. A few other specific exceptions also exist.*

†There are certain exceptions but they do not concern the plastics industry.

in many cases since it avoids the payment of fees to the authorized authority for its services, and the exact arrangements can be modified within reasonable limits to suit the administrative convenience of the manufacturer of the goods. When the ultimate exporter has incorporated components not of his own manufacture in the goods he exports he may well require a certificate of origin from his supplier of these components. It is thus common for a trade moulder or fabricator to be called upon to provide certificates of origin for his products even when these are supplied to customers in the home market. In this way plastics moulders and fabricators, a number of whom were disinterested in the Stockholm negotiations in the belief that they would remain unaffected by their outcome, are finding themselves directly involved in the problems of operating the schedules of the Convention.

Other matters covered in general terms by the Convention include the treatment of revenue duties and internal taxation, arrangements in respect of drawback of duties, balance of payments problems, State trading, restrictive business practices and dumping and subsidies.

Much literature has been published on the Stockholm Convention but at this stage of development of the Association the most useful document to provide a belated introduction to the whole matter for those not acquainted with it is, to my mind, a booklet produced by the Federation of British Industries entitled 'A Guide to the Stockholm Convention.' For those who are familiar with the general principles and provisions of the Convention much detailed information of value is contained in the Board of Trade's 'Compendium for the use of Exporters,' which is a HMSO publication.

TRADE IN PLASTICS

Materials

What does the Free Trade Association mean to the UK industry? By the end of the transitional period it will mean a 'home market' of 88 million people whose combined national income in 1958 was £28,000 million. The UK is by far the largest partner in the Association, but the other six nations contribute some 41% of the population and 37% of the national income of the area as a whole.

Accurate information on the plastics industries of the countries concerned is notoriously difficult to come by, but statistics of trade in plastics materials in their primary and semi-finished forms are available from a number of sources and in particular from the work of committees of OEEC. Table 2 gives some information on European trade in these materials, based on OEEC figures.

It will be noted that the EFTA countries import approximately twice as much from EEC as they export to it and this suggests a considerable potential for the expansion of trade in plastics materials within EFTA. The total UK exports of plastics materials in 1958 were almost 124,000 metric tons of which about 50,000 tons or 40% went to the two European trading groups, EFTA taking some 18% of the total and EEC 22%. These exports to EFTA were fairly well spread over the other six countries, bearing in mind their respective situations, the bulk of the trade going as might be expected to the Scandinavian countries. The Austrian figure is low but there was a substantial and welcome increase in 1959. German competition in Austria with the advantages of traditional links, a common language, and particularly of lower freights due to geographical proximity, is naturally even stronger than elsewhere in the area, but a glance at the figures in Table 2 (C) indicates the magnitude of that competition throughout the whole area.

Tariff discrimination against those outside the area, including Germany, may in due course help UK manufacturers to increase their share of these markets at the expense of those outside if they are prepared to make a determined effort to do so. At present, however, it must be admitted that a 20% cut on a really low tariff, say 3% or 5% *ad valorem* such as is levied by some of these countries on certain plastics materials, is a minute contribution which can presumably be met by adjustments in prices by competitors from outside the area. Nevertheless it exists and such adjustments are liable to have an immediate effect, however slight, on the profit margins of those competitors in these markets.

Within EFTA, Sweden appears as the UK's principal competitor with Norway second and Switzerland third, although the Swiss figures are not strictly comparable with the others. It is interesting although not surprising to note that 77% of Norway's exports to EFTA are to the UK. Norwegian manufacturers have

Table 2
European Trade in Plastics Materials in 1958 (Based on OEEC Statistics)
A—Trade within EFTA (Metric tons)

Exporter	Importers: Austria	Denmark	Norway	Portugal	Sweden	Switzerland	UK	Total EFTA	Total EEC
Austria	—	500	—	—	—	171	619	1,290	684
Denmark	262	—	266	—	459	—	895	1,882	386
Norway	—	189	—	—	885	—	3,659	4,733	3,751
Portugal*	—	—	—	—	—	—	—	—	—
Sweden	483	3,444	737	201	—	340	1,765	6,970	5,461
Switzerland	1,609	265	—	189	300	—	746	3,109	8,017
United Kingdom	905	6,290	3,878	3,004	6,421	2,350	—	22,848	27,959
Total EFTA	3,259	10,688	4,881	3,394	8,065	2,861	7,684	40,832	46,258
EEC	13,577	12,892	4,727	4,164	15,827	16,996	22,814	90,997	—

**Statistics not available, but grand total of Portuguese exports of the materials to world in 1958 was only 72 metric tons.*

B—EFTA Exports to EEC (Metric tons)

Exporter	Importers: Germany	Italy	Netherlands	Belgium	France	Total EEC
Austria	494	—	190	—	—	684
Denmark	268	—	118	—	—	386
Norway	2,782	206	483	169	111	3,751
Portugal	—	—	—	—	—	—
Sweden	1,959	499	1,859	649	495	5,461
Switzerland	4,135	799	249	729	2,105	8,017
United Kingdom	5,585	4,303	6,544	3,547	7,980	27,959
Total EFTA	15,223	5,807	9,443	5,094	10,691	46,258

C—EEC Exports to EFTA (Metric tons)

Exporter	Importers: UK	Austria	Denmark	Norway	Portugal	Sweden	Switzerland	Total EFTA
Germany	11,948	11,594	8,461	2,955	2,612	12,312	12,989	62,871
Italy	3,564	991	984	206	439	1,343	891	8,418
Netherlands	5,761	481	2,579	1,327	460	1,191	1,621	13,420
Belgium†	448	96	409	116	—	283	450	1,802
France	1,093	415	459	123	653	698	1,045	4,486
Total EEC	22,814	13,577	12,892	4,727	4,164	15,827	16,996	90,997

†Excluding PVC.

been quick to increase their efforts in the UK since EFTA came into operation.

The general situation in Europe shown by Table 2 indicates clearly enough the importance to plastics material manufacturers in the UK of some ultimate arrangement with EEC, particularly bearing in mind the relatively high rates applicable to plastics materials in the ultimate EEC tariff. Most of these will be between 15% and 23% *ad valorem*.

Mouldings and Fabrications

In the main sectors of processing of plastics materials, namely moulding, fabrication and extrusion, there is an almost complete lack of statistical information. The diversity of the products and the variety of their applications make this quite impracticable. A considerable proportion of the output of these branches of the industry is in the form of components for further manufacture or assembly. In this form there must be a large volume of indirect exports by UK manufacturers to the other countries of EFTA, but their identity is lost in that of the ultimate product. Moreover, to the trade moulder or fabricator this is part of his normal home market business and he frequently does not know how much of it is ultimately destined for export.

Each of the seven countries of EFTA has fairly well developed moulding and fabricating industries, and therefore has the required facilities for supplying the necessary components to its own manufacturers from local sources. There is a natural tendency to obtain components locally if possible; it obviates difficulties caused by delays or damage in transit; it reduces transport costs and it facilitates consultation and co-operation between customer and supplier.

The tariff situation of such products is complex since although many of them fall to be classified under 39.07 of the Brussels Nomenclature, a very large number are classified with the ultimate article of which they form a part. Plastics mouldings and fabrications when exported by one EFTA country to another may therefore fall in almost any part of the tariff and be subject to widely differing rates of duty. These duties will, it is true, ultimately disappear and this should encourage some growth of trade within the area in such products. The inconvenience of certification against a wide variety of definitions according to the Brussels Nomenclature item concerned will remain and this, together with the stronger motives for the use of local supplies already referred to, is liable to act as a brake on such developments. The same considerations would appear to apply to trade moulders and fabricators in all EFTA countries, and the growth of imports of such products to UK may therefore be expected to be fairly slow.

The position of those who manufacture proprietary articles is somewhat different. In this case there would appear to be greater scope for development of UK exports to the other EFTA countries. There is, however, similarly a greater expectation of competition in the UK home market from imports of such products from the other EFTA countries. Expansion of such trade would seem to depend to a considerable extent upon the willingness of individual manufacturers to study the requirements and customer tastes of the various countries concerned. In this connexion competition from Swedish moulders arising from their emphasis on advanced designs, may be expected to increase in the UK.

INDUSTRIAL CO-OPERATION WITHIN EFTA

The responsibility for administering the Stockholm Convention has been vested mainly in existing Government institutions in the member countries, and the establishment of new international bodies has been kept to the absolute minimum. This is a most desirable arrangement which we must hope will prove successful.

Increased international co-operation and liaison will no doubt be necessary in the future and will be welcomed by the British plastics industry.

Whether or not some special international body consisting of the representatives of the plastics associations in EFTA countries should be established is a matter which no doubt will be discussed between those organizations in the coming months. In the course of any such discussions account will need to be taken of the differences between the structures of these associations in the different countries of EFTA and of the organization already established by the chemical industries of these countries and EEC under the title Centre Européen des Federations de L'Industrie Chimique (CEFIC).

The relationship of any such body with the Plastics Co-ordinating Committee of EEC or with any other such European organization for the plastics industry which may be formed would also need most careful consideration. The British Plastics Federation has for some time co-operated closely with the plastics associations of the other countries of EFTA, particularly those in the Scandinavian countries, and whatever the outcome of further discussions may be the Federation will continue to watch the interests of the UK industry and to co-operate wherever possible with the plastics associations of other European countries, particularly with those within EFTA with the object of advancing the cause of free trade in Europe.

Vitafoam Cut Prices

Vitafoam Ltd. have announced a 2½% price reduction on a limited range of upholstery cushions. The announcement coincides with the beginning of the company's 12th financial year.

Vitafoam attribute their lower cost of latex foam cushion production to the successful use of synthetic (SBR) latex produced by the International Synthetic Rubber Company. Vitafoam have also expressed confidence that more price reductions will be possible through further production economies now being developed.

Certificates for 1,825,000 £1 ordinary shares of Imperial Chemical Industries were despatched recently to I.C.I. employees under the company's profit-sharing scheme.

Translucent eye-screens moulded in Rigidex high density polythene are being used on street lighting fittings in Liverpool and district. The new screen is designed to be attached to the reflectors of pendant and column lighting fittings to prevent glare without significantly reducing illumination over a wide area

Prospects for Rubber Manufacturers

SPECIALIZATION, ADVANCED TECHNOLOGY AND SALES EFFORT TO MEET WIDER MARKETS BUT MORE COMPETITION

By E. N. LOWE

THE rubber industry has done well overseas in the last year. At a time when the trend of exports as a whole from the UK has been causing concern, the industry can take pride in being amongst the select few who considerably increased the value of their exports. The national average shows a growth of 9% in the first seven months of 1960, but in the same period the rubber industry increased its sales abroad by nearly 14%. Interested readers will find statistics elsewhere in this issue which will show where this achievement has been won.

Whilst the result is an undeniable proof of hard work and successful effort, no one will wish to do other than try for more, and the present is a good moment to examine the factors that have enabled us to sell abroad on the scale we have, and to attempt to appraise both the opportunities and the difficulties which are likely to confront the industry in the coming months overseas.

Some of the questions to which we all would like an answer are whether the growth of the rubber industry's exports can be continued; whether the rate of expansion can be increased; what the effect of the Common Market, which is gathering strength so rapidly, will be; what the prospects within the European Free Trade Association are; what prospects may be looked for in the Commonwealth, in the under-developed countries.

Complex Industry

One is, in embarking on any analysis, immediately conscious of the complexity of the industry and its international character; and is painfully aware that no generalization can cover the situation of every manufacturer. Not only does the industry produce products for every sector of modern life from heavy capital equipment through consumer durables to the lightest and brightest of consumer goods; from technical products so advanced as to be at the frontiers of technological progress, through well tried staples to the gayest and most ephemeral of fashion goods; but the member firms themselves display almost every variation of scale and type.

On the one hand there are internationally known giants, widely diversified and widely spread; on the other, small specialist companies concentrating on a small range of products. In addition, there are other members, often large in their own right, producing a restricted range of more specialized products as a complement to their main activity in some other industry. In total the industry represents the second largest complex of rubber manufacturers in the world with traditions of quality and craftsmanship second to none.

The versatility of rubber as a raw material means that whilst some products require substantial investment in plants for their production, there are many that do not require a particularly large capital investment by modern standards. These products lend themselves to manufacture in countries that are relatively underdeveloped industrially no less than in those heavily industrialized. A local rubber industry therefore exists on some scale or another in some products or others in the great majority of potential markets overseas. In the past twelve months this trend for manufacture to spread geographically has continued. It will undoubtedly continue in the future, but need not of itself mean that the demand for British rubber products overseas will decline.

THE AUTHOR

E. N. LOWE joined the Dunlop Rubber Co. Ltd. in 1946 *and started to learn about rubber by making tyres at Fort Dunlop. Now aged* 40, *he served through the war in the Navy having joined the R.N.V.R. in* 1937. *He joined B.T.R. Industries in* 1957 *and is now General Overseas Manager. He makes service in the R.N.R. his hobby so far as travel permits, but states that his ambition is to be a fare-paying passenger in an ocean-going ship.*

Local production is often coupled with local nationalism, and the latter in its desire to establish local production at all costs often interferes with the fair competition between the products of different qualities and different sources of origin by the erection of customs barriers, currency restrictions, and the institution of physical quotas. Whilst one can have every sympathy with a community seeking to raise its standards by fostering local industry, one can wonder simultaneously whether the effect on other enterprises in the country—such as obliging them to pay higher than world prices, quality for quality, for the rubber products they need to operate with—is always fully appreciated; not to mention the effect sometimes of denying them, as a result of quota regulations, the latest developments altogether. At first perhaps of minor importance this could be an increasing handicap to the users of rubber products if they themselves have to compete on world markets with their products. So long as this trend continues exports to countries with nationalist aspirations may have an artificial ceiling imposed on them, and the growth of the British industry's exports to them cannot be taken for granted. The industry is entitled to expect our Governmental posts abroad continually to use their influence to keep markets open for free and fair competition.

The Commonwealth

This trend to protect local manufacture is found in Commonwealth countries no less than those to whom the UK does not extend reciprocal customs preferences. Although there has been a welcome easing of import restrictions into Australia there has been a whittling down of Commonwealth preferences in favour, in particular, of Japan at the same time.

This is due to the effect of the provisions in the General Agreement on Tariffs and Trade (GATT), which require that margins of preference should not be increased. A duty imposed to protect a local industry from a low cost producer such as Japan has to be imposed on the imports from all other countries, even though they might be higher cost producers than the importing country, Australia, herself. Before 1947 the same duty need not have been imposed on British goods had Commonwealth preference been granted, but since that year GATT requires the British Preferential tariff to be increased whenever the general tariff is increased, even though the Australians have not the slightest need or desire to do so. As the Director of the Australian Association of British Manufacturers has pointed out, this presents an insoluble problem unless the Commonwealth Government is willing to depart from its policy of protection by tariffs alone.

In two other major Commonwealth markets, South Africa and Canada, applications for increased tariffs on imported industrial rubber products are under consideration. In both instances the opposition by the user industries to the proposed increases and hence to the increased cost of British rubber products was, particularly in Canada, noteworthy; and may possibly not have been without effect. In Canada the relative increase in duty being sought on British products approaches three times the increase being sought on the products of other nations—and is another indication of the way in which Commonwealth preferences are tending to be whittled down.

Also during the year there has been a change in New Zealand which may well favour local manufacture. For many years a country of low tariffs but tight physical import control, now moves are being made which could lead to tariffs being increased whilst physical controls are eased. Whilst in theory the New Zealand manufacturer will as a consequence be open to competition from an unlimited volume of imports, he will at the same time be protected by tariffs even on the imports hitherto admitted under licence. It will be interesting to see the outcome because for each importer there will, as the New Zealand governmental policy is implemented, be no theoretical limit to the share of the market he might obtain, but the road to success is going to be much harder.

These current examples of increasing handicaps in the traditional markets for British goods in the Commonwealth exemplify the trend of the last two decades or more. It has been estimated that between 1937 and 1948 the share of UK exports to Commonwealth countries receiving preference fell from over 56% to around 50% and that the average margin of preference on these goods fell from about 20% to 15%. Since then preference margins have fallen further and may be expected to continue to decline.

It follows that whilst business with Commonwealth countries might well be capable of expansion, and almost certainly will be in the short run, these markets cannot be taken as much for granted as they may have been in the past, and it will be with the more advanced products, technologically speaking, that future gains will be made. Even so, vigorous sales development will be needed if the industry is to maintain its share of these markets and not to continue to lose ground in relative if not absolute terms.

Other World Opportunities

Large quantities of rubber products are used in the non-Commonwealth, non-European countries. Even today their economics are mainly based on primary production despite rapid industrialization, and as a consequence may be expected to be importing substantial quantities of rubber products. Such statistics as are available bear this out, but over a five-year period they also show that there is a downward trend, due no doubt to increasing local manufacture. However, local manufacture does not occur for every product, and a downward trend does not necessarily mean that the prospects for the British industry must similarly decline. In individual sectors British industry may have excellent opportunities to compete against the other exporting countries for the substantial custom of the countries concerned — and which is likely to remain substantial for many years to come. Argentina, Brazil, Columbia, Peru, Venezuela and Mexico, by way of example, imported between them around £8,000,000 of rubber products in 1958. As by far the greater part came from the USA, a challenge and an opportunity exists for this country. It will nonetheless be a difficult task, for many of the consumers in these countries are tied by sentiment, finance and training to North American sources rather than European; and the trend to protect local manufacture must steadily infiltrate into even the most internationally-minded customer.

Whilst in both the Commonwealth and non-Commonwealth markets outside Europe the trend of political practice makes export harder, there are factors working in the direction of increasing trade, and there is no reason why business should be allowed to pass elsewhere without good reason. The centre of interest in mineral exploitation and in new mining projects is shifting increasingly to the world's under - developed areas. Indeed, the exploitation of mineral resources so often provides the first step in the economic advancement of emergent states. Even coal mining, thought of today in many western countries as being excessive and due to decline, has on a world basis continued to expand steadily; and in 1958 one study group is reported as estimating that new investment to the tune of £2,000m. p.a. is needed to take account of the prospective rise in world consumption of metals and fuel minerals. The opportunities this presents the rubber industry needs little stressing and, mining apart, the quest for more power and more irrigation in the emergent countries spells yet further increasing demands for rubber products, particularly the heavier products such as off-the-road tyres, conveyor belting and hose. Major projects such as Kariba, Aswan, Volta, and the Mangla and other dams in the area of the Indus headwaters can almost be counted by the dozen.

Europe the Decisive Market

Nonetheless, however bright the short and medium term the political trend against imported products underlines the importance of Europe, where barriers are decreasing rather than increasing. There is no need to stress the size of the market, nor its rate of growth. Here major projects of basic development give place to a multitude of specialized customers having continuing and expanding business to place. For most manufacturers Europe is the decisive market.

The past year has been the first full year in which the European Economic Community, the Common Market, has been in operation; and it has seen the European Free Trade Association start into life. Such tariff changes as have as yet been implemented are hardly big enough in themselves to have had a serious effect on the export pattern of rubber products. The full effect is to come. But, though small, the changes have had a significant psychological effect, which has probably been sensed by most importers and exporters even though it is impossible to express it quantitatively. The influence of non-price factors on the decision to purchase one manufactured article rather than another is always difficult to assess. A conscious and cultivated willingness on the part of many purchasers to examine alternative sources of

supply, not to take old-established contacts for granted, has been noted in several quarters. Every exporter needs to be 'mending his fences' as well as looking for new opportunities.

We can look forward to a new duty free market of 25m. people in EFTA, whilst in the other direction the Swedes and Austrians can look forward to duty free markets of 70m. and 74m. people, because to them the UK has hitherto been a highly protected market. There is a strong progressive rubber manufacturing industry in the Scandinavian countries and also in Austria, and if a country's import of rubber, natural and synthetic, may be taken as a guide, the Scandinavian industry is rather less than one quarter the size of the British, and the Austrian and Swiss industries rather more than one-eighth. These industries will undoubtedly aim to penetrate our home market, and the competition they will engender will have to be respected. Indeed, there has been an increasing import of rubber products from the EFTA countries for almost two years. So far it is still much below the import from the Common Market countries, of the order of one-tenth as much. Assuming that increased imports from EFTA will in the first place tend to displace Common Market imports, there would still seem to be plenty of room for substantially increased imports from EFTA before the UK market would be seriously dislocated. But as ever in so varied an industry this may not be found true if an analysis were to be made into individual products.

EEC and EFTA

On the other hand, a sizeable part of the rubber products imported by the Continental members of EFTA, in particular Sweden, Switzerland and Austria, has been coming from Common Market countries, in particular, Germany. This trade is one in which the British industry will need to make special efforts to win. The first essential is to convince the customer that we can make what he needs and deliver it when he wants it. In Switzerland and Austria, Britain seems far away, Germany is so close.

The publicity for the industry as a whole which is to be organized to this end by the FBRAM in the EFTA countries is particularly welcome, and the scheme is worthy of wide support. The months to come are not ones in which to hide our light. Although exports to the other EFTA countries are expanding already, there is still room for a very substantial increase —and without detriment to the other EFTA rubber industries themselves.

The future for trade with the Common Market countries has been demonstrated less clearly during the year. Logically it should be taking a downward turn, but in fact it has increased. The liberalization of imports into France and the surge of industrial prosperity in all six EEC countries has masked the effect of the tariff changes which have taken place, and the future is further complicated by the complexities of the GATT, which has a bearing on the tariff changes proposed in the years to come. Under the Treaty of Rome the 'Six' plan to harmonize their outer tariffs whilst continuing to reduce their tariffs between themselves. Practically all the Benelux (and some of the French) tariffs on British rubber manufactures will be increased, whilst those on the manufactures of Germany, Italy (and France) will be reduced and eliminated. This discrimination could be contrary to GATT were compensatory concessions not conceded by the EEC. The German and Italian tariffs on British rubber manufacturers are due to be reduced as the Benelux tariffs increase. This constitutes a form of in-built concession which the EEC countries are entitled to have taken—and no doubt will take—into consideration when in negotiation. Whether these concessions will be adequate will need careful study, and our trade negotiators will be alive to the situation during the forthcoming GATT negotiations.

If, as we all hope, fair compensation is achieved, then, taking the Common Market as a whole, access should be no less favourable than now, although somewhat different in shape. This would mean that the intensified competition which may be expected within the Common Market as the local rubber industries compete for the bigger rewards of the bigger market could at least be faced on terms no worse than exist at present. The problem will be competition from those firms that rise to dominance in those sectors of the industry where the costs of production are particularly susceptible to reduction when volume increases.

There have been forecasts that industry in the Common Market will pass through a period of concentration and that the smaller manufacturers will be eliminated. It is possible that such forecasts, whilst true of some industries, do not sufficiently take into account the complex pattern of the rubber industry. Concentration could take the alternative form of reorganization within individual companies rather than the concentration of the firms themselves. Most rubber manufacturers make a variety of products, and in future the trend may be for each firm to reduce its range, cutting out the products at which they are less efficient and concentrating on those items at which they are best, and hence make more profitably.

This would present British industry with an obvious pressure to do likewise; and as the same tendencies will be at work within the Outer Seven it may well be that throughout Europe as a whole the rubber manufacturer of the future will be producing an appreciably narrower range of products than used to be the case, but will be selling them on a compensatingly larger scale.

The Prospect

The prospect for the rubber industry is, therefore, one of increased potential outside Europe, but of steadily increasing handicaps to be overcome in securing it; of considerably improved prospects in the Outer Seven, but with an urgent need for additional sales effort to change old-established buying habits even though many potential customers are willing to consider a change if not to actually make it; and of heightened but not hopeless competition in the Common Market, which if met with agility could result in substantial business gains for efficiently produced specialities.

Most rubber products are either components of other manufactured products or are used by industry, particularly primary industry, with the object of saving labour by increased mechanization. Components for the aviation, automotive and domestic appliance industries are examples of the former; conveyor belting, hose and V-belts examples of the latter. With labour becoming more and more skilled and higher paid as industrialization proceeds, so the world market for both categories is rapidly increasing. As the total market expands so does the market for products with higher performance. More and more the demand is for hoses that work at higher pressures, or are more flexible or lighter; conveyor belts that carry more tons per hour for more hours; V-belts that transmit more power; rubber mountings that are more durable; and so on throughout the entire range. The highly developed state of the industry in Britain, its technical depth, and its strong tradition of quality implies that it is particularly well placed to maintain its place at the forefront of the international market. A user may be sure that his many varied requirements will, if placed with a British firm, benefit from long experience married to advanced technology; and that he will receive not only the product but the performance he needs.

German Rubber Congress

WORLD-WIDE ATTENDANCE IN BERLIN

THE congress in Berlin from October 4-8, organized by the Deutsche Kautschuk Gesellschaft (German Rubber Society) was opened by Dr G. Fromandi, president of the DKG.

He expressed his thanks to all the people and organizations who had worked so hard to make the congress possible and welcomed all the representatives of the German Senate and Federal German Ministries who were present. He then extended a warm welcome to all the representatives of organizations and scientific institutes from Germany and abroad who were attending the congress. Approximately a thousand specialists from 25 countries had come to Berlin to hear 62 lectures given by contributors from 13 countries, dealing with various aspects of synthetic rubbers and man-made fibres.

During the last 30 years, said Dr Fromandi, developments taking place had opened new fields and had laid the foundation of the synthetic rubber and man-made fibre industries which were now of vital importance in the world economy. The lectures to be given would, he was sure, reveal not only the international character of the science and technology of rubber and fibres, but would also show that continued development was in progress that would greatly benefit these industries.

Franz Amrehn, Deputy Chief Burgomaster of the City of West Berlin then made a short speech of welcome on behalf of the city. Although, he said, as far as the actual manufacture and production of rubber goods was concerned, Berlin played only a very small part, they were happy that Berlin had been chosen as the venue for the congress and could thus contribute to the exchange of knowledge which would help not only the German Rubber Industry but would also be of benefit to mankind by helping to promote better international understanding.

Presentation of the Carl Dietrich Harries plaque for services to the rubber industry was then made by Dr Fromandi to Professor Dr Paul Baumann of Chemische Werke Hüls and Dr Hermann Holzrichter of Farbenfabriken Bayer. The award to Dr Baumann was for his work in the development and production of synthetic rubbers and particularly for his part in the development of the SBR plant at Buna Werke Hüls. Dr Holzrichter has contributed much to the knowledge of polymerization techniques and methods and to the development and production of synthetic rubbers.

Butadiene Impetus

The first of the plenary lectures was delivered by Dr Baumann who spoke on the development of synthetic rubbers since 1930. He considered that the introduction of butadiene as a component for polymerization had given tremendous impetus to the synthesis of rubber and that the emulsion polymerization process was also of considerable importance in placing SBR at the top of the list of synthetic rubbers. He stated that the estimated production capacity available for SBR in 1960 was actually greater than the production of natural rubber. Other synthetic rubbers which he considered to be of particular importance, despite their relatively small production, were polybutadiene, polyisoprene and the polyurethanes which he said were of great interest because of their good resistance to abrasion and high tensile strength. He also spoke of the considerable interest being taken in ethylene-propylene copolymers and forecast that these materials would in the near future be competing in the tyre market.

The development of man-made fibres for industrial applications was the subject of the second plenary lecture given by Dr Alfred Ebert of Vereinigte Glanzstoff-Fabriken AG. Trends in textile fibre consumption in the West German rubber industry since 1949, he said, showed that cotton had dropped to about one-third of total consumption while filament rayon accounted for almost two-thirds. Staple rayon and the other synthetics as yet played only a moderate part. Tyres in West Germany used 88% rayon reinforcement, while in America nylon was approaching 25% and in France the advent of steel cords had resulted in different developments so that the pattern varied considerably in the various industrial countries. Dr Ebert then described the development of and properties of the synthetic fibres in use and those under development such as polypropylene, and polyvinyl alcohol which although not new is attracting some attention in Japan.

He concluded by saying that there was no synthetic fibre which had only favourable and desirable properties, but that continued research would always be necessary to find the best possible material for each particular field of application. He looked forward to a continuation of the co-operation which had always existed between the rubber producers and the synthetic fibre manufacturers.

Dr G. Fromandi, president of the German Rubber Society, presents the Carl Dietrich Harries plaque for services to the rubber industry to Prof. Paul Baumann, Chemische Werke Huls (*left*), and Dr Hermann Holzrichter, Farbenfabriken Bayer.

VIEWS *and* REVIEWS

ONE of the most important exports of any country is its literature — and I use that word in its two senses, the wide one meaning its written art, and the narrow one meaning its technical and scientific writings. Neither can be exactly measured in cash, in fact the monetary return is often less than the cost of production and almost always less than its real value.

Such a consideration rarely arises, however, in the scientific mind. To the scientist, publication is one of the bases of the scientific method and temper, despite appearances to the contrary in the political world of national armaments, and publication means international dissemination.

We in Britain are indebted to many nations for the technical literature they send us and our return is not just the £ s. d. we pay for it but the literature we ourselves write, print, publish, send, and sell to them. One of these British literary exports is the *Transactions and Proceedings of the Institution of the Rubber Industry*.

Volume 36, No. 4, dated August 1960 has just been published and I would like to draw attention to it, not for its usual complement of original papers but for its summaries of current knowledge in two separate fields.

New and Old Knowledge

Of course we need new knowledge. Of course we need societies to encourage the acquisition of new knowledge and journals to publish it when it has been won. But we also need, from time to time, reviews to date of existing knowledge. We need such reviews at different levels of detail and expertness, for different purposes and different readers.

We need them to help us decide which direction to take next, where the gaps in our knowledge are; we need them to inform new workers in the old field, and to keep workers in other fields abreast of progress in ours. And they have a value, perhaps above all, in giving the compiler, who is almost always continuously immersed in the details, the opportunity to get things in perspective for himself, to see the wood as well as the trees.

The August number of IRI Transactions has two such summaries and reviews of current knowledge: 'High Polymers' by Maldwyn Jones, and 'Bonding Systems' by W. A. Gurney. Both were delivered as IRI lectures earlier this year, 'High Polymers' was, in fact, the Foundation Lecture, delivered on May 20, in Manchester.

A Manchester Model

It will be well-known to British readers that Manchester is famous for two things: a climate and a newspaper (though recently it took steps to disguise the latter by dropping the name 'Manchester' from the title). But the world ought also to be told that Manchester is a centre of culture and intelligence, with a proud tradition of local achievement in many fields of art and science. It was therefore quite fitting that it should be in Manchester that so notable a lecture as Maldwyn Jones's should have been delivered.

To have set out to write neither a book nor a paragraph but something between the two on the subject of 'High Polymers,' with the ambitious subtitle 'The Story of an Age in Theory and Practice,' was courageous and not, it might have been thought, likely to succeed. But, succeed it did.

To such a difficult task there are not many people who could have brought Maldwyn Jones's wide background, grasp of detail, and practical acquaintance with polymer problems. Reading this lecture (I did not hear it delivered) I am struck especially by its flow, its enthusiasm, and its insight. It sets out to get somewhere and get there it does.

It has other qualities too; for instance, although he knew he was addressing fellow scientists, he did not fall into the elementary trap of talking above their heads. We all know admirable technologists and scientists who are unable or unwilling to think and write simply enough for their readers to understand without much effort, but Maldwyn Jones is not one of these. All his likely readers will at least think they are understanding what he is saying and this is the first step to real understanding.

He has had to simplify, and although to the expert it may be oversimplification, he is addressing himself to the non-expert but intelligent, and simplification is in these circumstances a virtue. It was a model of what a Foundation Lecture should be. The man who first thought-up the idea of a Foundation Lecture must be particularly pleased at the way Maldwyn Jones has fastened on to the conception and exploited its potentialities in this, the 15th in the series.

If I have one criticism, it is that it is too long — as a lecture — though not too long to read. It is all of 16,000 words long and a lecture as long as that requires, however good the lecturer, a lot of audience goodwill and indeed of sheer physical endurance at bottom. This is a criticism of the idea of the Foundation Lecture itself, which is intended to be a weighty pronouncement by an expert on his life's work. Could you exhaust your life's work in three hours' talk?

It is not my intention to try to summarize the lecture here (that was done in *RJIP* May 21 1960). Get the original for yourself. But you may like to hear of the scope and quality of the lecture.

A High-polymer World

Ourselves constructed of high polymers, we live in a world of high polymers. Our knowledge and understanding of such materials has been won almost entirely during the lifetime of those of us now gainfully employed in the high polymer industry. We have been witnesses to a technological evolution so rapid as to have brought about a new age in human history.

From the point of view of simple figures, 'the picture, then, is one of plastics production at a present rate of about 4m. tons per annum, with synthetic rubber at about one-third the rate and synthetic fibres intermediate between

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **F. C. JENNINGS**

the two. Another significant feature of their place in the economic structure is that whereas costs of living have been increasing in common with prices of a host of raw materials, polymer prices, particularly those of the plastics, have steadily fallen and the end of the trend has not yet been reached.' Charts and diagrams give many details for this picture.

From there onwards, Maldwyn Jones's own 'chapter headings' are: History of polymerization, The physical nature of high polymers, Crystallization effects, Processing behaviour and thermal history, Control of polymerization, Factors influencing the rubber-like state, Polymer blending, and The future. It is a story of increasing control resulting from 'the interplay of chemical synthesis and the elucidation of physical structure and the development of evaluation techniques.' As Maldwyn Jones tells it, it is a fascinating story, and I can hardly forbear to quote, yet if I began I would not know when to stop.

Towards the end, he asks the simple question: 'Why in particular has there been such a rapid influx of polymer discoveries — or perhaps more accurately developments — in the past 30 years?' He cannot discern a set pattern but he comes to some valuable conclusions. He says: '. . . it is perhaps more important to work in a field of chemistry than to work towards a precise performance target, and to cultivate an atmosphere of research and skill in experimentation. Secondly, it is essential to appreciate the possibilities of chemical inventions and to exploit them by the development of a complete technology. If we are to continue to make important discoveries these essentials must be provided. This means in the first place, basic and advanced training and it is almost certain to mean mass effort . . .'

In conclusion, he has a look at the materials and processes of the future, the weaknesses (such as susceptibility to oxidation and ageing), the ideals (strength, clarity, cheapness), and finally he refers to 'the greatest of all,' 'the quest for the reproduction of the natural high polymers of the human body.'

His parting words are an epitome of the spirit in which the whole of his lecture is written: 'If this is the end of one era it is certainly the beginning of another.' Let us hope the new one will have as able a chronicler.

Bonding Systems

The other useful review and summary in *TAPIRI* for August 1960 is by W. A. Gurney and deals with 'Bonding Systems,' a title admirable in its brevity, definition, and comprehensiveness. The author, to my knowledge (and there is internal evidence in his paper also), has been an authority in this field for over 25 years and although he has less to say about his subject than I would have expected, his characteristic bright and incisive turn of phrase flashes occasionally in this otherwise plain setting.

He limits bonding to 'the permanent attachment of a rubber to a solid substrate' and excludes mere sticking by simple adhesives. Perhaps his attachment 'by means of heat and pressure,' 'generally during the vulcanization process' is a gratuitously unnecessary limitation. I would have thought that bonding is a state reached independently of a process, the integration of adjacent surfaces to such a degree that during an attempt at mechanical separation it is one of the bonded materials which is destroyed.

He makes a good point in approving the term 'system' because 'it emphasizes the importance of all partners in a bond,' a change in one of them necessitating contingent modifications in another. Indeed, his theme is that it is 'only by attention to all details that bonding can be carried out successfully and consistently. Bonding is a notoriously variable process . . .'

He is 'driven to the view that fundamentally elastomers and metals are incompatible and their union is only achieved by a precarious balance of chemical and physical conditions.' Conditions he stresses are cleanliness in the workshop, the great importance of the natures of the surfaces involved, and the crucial, vulcanization-moulding process (see that the rubber is 'in the right place at the right time').

Optimum Conditions

He concludes that 'there are sharply defined optimum conditions when a satisfactory bond can be obtained. In particular:

(a) There is an optimum cure for bonding.

(b) The nature and condition of the surface of the substrate is important.

(c) An inadequate or an excessive chemical modification of adhesive or rubber will result in bond failure.

(d) There is some evidence that the chemical conditions of the compound may need to be balanced to the surface conditions.'

He discusses somewhat superficially (but perhaps he was trying to fit it all in to a reasonable length for a spoken lecture) some of the theoretical aspects of brass-plate bonding and the roles of copper, zinc, and curatives. He makes brief references to selenium bonding and the use of phenol formaldehyde resins with nitrile rubbers.

Starting with the statement that 'Polyisocyanates have considerable value in rubber bonding, as with their aid almost any elastomer may be bonded to almost any other material,' he tells an interesting story about Desmodur R and its high bonding strength when used with phenol formaldehyde resins, and the value of controlled oxidation of the metal surface when using isocyanates.

'Recent years,' Gurney says, 'have shown a large increase both in the number of proprietary solutions for bonding rubber to metal, and in their reliability.' They are often based on the use of an interlayer 'with a foot in both camps' but there is a danger in going too far in either direction and losing bond strength.

All technologists will echo his grumble about the lack of technical information released by some manufacturers. 'Advertising literature is of little use, since it is understandably concerned with what the adhesive will do rather than with what it will not. To the scientist, what an adhesive will not do is the more interesting, although a little can be learned by reading between the lines.'

Naturally, 'Bonding Systems' is not of the same calibre as 'High Polymers' — Gurney would be the last to claim it to be so — but it is a useful summary of the subject. Together the two of them make this issue of *TAPIRI* a good one, worth recommending at home and overseas.

CHARLES JENNINGS

MEN *and* MATTERS

A Review of People and Events

by Peter Richards

IT is appropriate that this, the export issue of *RJIP*, should coincide with the recent opening of a large new plant extension by Halex, since this division of British Xylonite is one of the most export minded of UK plastics moulders. The company gives priority to overseas markets and, at the opening of the new extension it was disclosed that direct exports plus the export of component parts, provided for industrial customers reached a conservative estimate of at least £700,000 a year.

The £41,000 extension will produce larger injection moulding units for consumer and industrial markets; injection moulding machines installed have cost £100,000 (*RJIP* August 20, 261).

Collars to Refrigerators

Not many moulders have been going so long as Halex. It was in 1897 that British Xylonite bought Jack's Farm in Walthamstow and set up a factory producing celluloid articles: combs, hair brushes, collars and cuffs. Today the biggest use of celluloid at Hale End is for table tennis balls. As the world's biggest manufacturer, 30 million are produced a year, of which 55% are exported — the largest quantity going to USA.

Due to the fire risk of celluloid, the original plant was constructed as a series of small, well spread out buildings. This is a handicap to the firm which now produces much bigger units in the domestic goods' field, refrigerator linings and car parts; all of which demand space for efficient planning.

The constrictions of the old buildings contrasts with the company's modern outlook. In 1945 2,000 people were employed. Today there are only 1,300 — but with mechanization turnover is three times as much. But modernization of the lay-out is taking place by stages. The new building is a step in that direction, 'And,' said A. B. Merriam, the works manager, 'it will not be the last.'

In the Air

BOAC and BEA can relax. Dunlop is not going to buy an airline. Recent remarks in these columns about the new Dunlop symbol, and the suggestion about it of something to do with aviation, have brought a possible explanation. It has been pointed out that the Dunlop Aviation Division supplies over 400 different items of equipment for aircraft, from small rubber mouldings to anti-G suits, not forgetting tyres, wheels and brakes.

Halex 100th factory opening ceremony October 3 1960. From right to left, Mayor of Walthamstow, Ald. W. R. Baldwin, J.P., and the Mayoress examine with Lady McEntee a Halex product, on left is Sir Laurence Merriam
(*See first story*)

Geon Changes

As part of the company's further expansion programme, British Geon has recently made several new sales and technical service appointments. A. H. Fletcher has been appointed sales manager, Geon PVC resins and latices; and H. A. Wardle has been made sales manager for Hycar nitrile rubbers and acrylates. Both these appointments are promotions within Distillers Plastics Group.

H. A. WARDLE

D. J. Pretorius, who has joined the company from National Chemical Products Ltd., South Africa, will act as sales manager, Geon PVC compounds.

A number of people have been promoted to new posts in the company's technical service department: E. J. Hoskins has been made technical service manager, Geon PVC dispersion resins; W. S. Mure technical service manager, Geon PVC pastes and latices. Stanley Mottram, at present technical service manager, becomes chief technical service manager.

A. FLETCHER

D. PRETORIUS

Rearrangement at Artrite

Artrite Resins Ltd. have announced that B. J. Phipp, technical sales manager, has been appointed technical manager, and P. Harryman marketing manager.

The company tells me that, because

of its increased activities and to ensure a comprehensive technical service to customers, Mr Phipp has been given this new appointment in order to devote himself exclusively to technical matters. Mr Harryman takes over the sales functions formerly carried out by Mr Phipp.

Cromwell Add Directors

The Board of E. M. Cromwell and Co. Ltd., which specializes in the formulation of synthetic resins and the manufacture of specialized decorative reinforced plastic articles, has recently been strengthened by the appointment as directors of the Rt. Hon. the Earl Fitzwilliam, M.R.H., Mr H. N. Sporborg, C.M.G., J.P., and Mr E. Clayton, managing director of the Netherton Building and Construction Co. Ltd., of Peterborough. The last named will assist in the development of the company's expanding interest in the provision of formulated plastic materials for the building and construction trades. Mr Jaffrey Rowland remains as managing director of the company.

Fablon in Park Lane

I hear from Fablon Ltd. that the company now has a private showroom at their Park Lane (No. 49, opposite the Dorchester Hotel) offices to demonstrate their latest product — Fablonite.

The company announced the launching of this decorative melamine laminate three weeks ago, laying particular stress on the quality and breadth of their range. All the standard Fablonite patterns and plain colours can be studied in the new showroom, including the Harmony range of exclusive two-tone designs.

Everybody who is interested is welcome to see, as Mr R. T. Copp, sales director, puts it, 'what the most modern laminates plant in Europe has produced.'

Handycans for Hillary

Over two hundred containers blow-moulded in British Resin Products Rigidex high density polythene by Lacrinoid Products Ltd. have been supplied to the British Petroleum Co. Ltd. for transporting and storing the kerosene fuel to be used during the Himalayan scientific and mountain expedition, led by Sir Edmund Hillary.

The containers have been chosen by BP, who are providing all the fuel and lubricants and have assisted in developing certain special heating and cooking appliances, for use by the expedition during its three month stay in the Himalayas. They have been extensively tested at the BP research centre, Sunbury, for performance at low temperatures and high altitudes.

Two hundred two-gallon containers and twenty one-gallon containers will be used. All are fitted with non-spluttering detachable pourers, now standard on all Lacrinoid's Handycan containers.

Blaw Knox Appointment

Blaw Knox Chemical Engineering Co. Ltd. has appointed Maurice Vincent technical sales manager.

Mr Vincent graduated from Bristol University and has had extensive industrial experience including the supply of plant to the process industries.

From 1955 until 1960 he was in charge of the process laboratories of Shaples Centrifuges Ltd., and, before that, development chemist with Murgatroyd's Salt and Chemical Co. Ltd., who supply most of the chlorine to British Geon's PVC plant at Barry, Glamorgan.

Creators Add

Creators Ltd. of Woking, manufacturers of injection mouldings, extrusions and fabrications, have announced new appointments in their technical sales organization. Mr R. Martin joins the company as technical sales manager with Mr J. Buchanan representing the motor and Mr H. A. Wheatley, the furniture industries.

* * *

Richard Riley is the new president of Firestone Rubber and Latex Products Co., a division of Firestone Tire. He succeeds C. J. McCready, who has resigned.

Question Corner — 139

(Second Series)

464. What factors affect the heat sealing of polythene film?

(Answer next week)

Answer to Question Corner — 138

463. Wrinkles in blown film is a problem which intermittently occurs and wrinkled rolls must be scrapped immediately.

Wrinkling on the wind-up roll may be due to any one of a number of factors.

(a) The die ring may be out of adjustment resulting in gauge variations causing uneven pull.

(b) The guide rolls may not be properly aligned with the pinch rolls. The roll nip must be positioned exactly above the die centre so that the tube will be pulled off exactly vertically.

(c) The ascending tube may be wobbling due to melt surging from the extruder, or air currents in the shop.

(d) The pressure across the face of the pinch rolls may not be uniform because the rolls are either not parallel or slightly eccentric. The rubber surface of the rolls may quickly deteriorate in which case they will need regrinding or reconditioning so as to maintain proper resiliency.

(e) The 'frost line' may be too high. This may cause poor gauge control around the circumference of the tube and uneven gauge in the film. This can lead to unbalanced pull in the pinch roll nip and wrinkling results.

(f) The film may be too cold when it reaches the pinch rolls and the resulting relative stiffness may cause crimping at the nip, and wrinkling.

(g) The use of resins of higher density will increase the stiffness of the film and its susceptibility to wrinkling.

(Another question next week)

Polly Ester Says . . .

'Coating materials—naturally I prefer mink'

BPF at Scarborough

'HIGHLY SUCCESSFUL CONFERENCE PAPERS'

THE papers delegates heard at Scarborough were the most successful yet delivered at a British Plastics Federation conference said the chairman, David Radford. He was speaking at the Federation banquet which climaxed the conference.

Running from October 5-8, at the Grand Hotel, Scarborough, the conference was attended by about a hundred delegates representing 38 firms.

The most provocative paper delivered on October 6 was given by H. C. Raine (I.C.I.), who talked on the value of research to the plastics industry. The topicality of the subject was underlined by the announcement from the chairman that the proposed joint plastics and rubber research association at Shawbury was 'now virtually an accomplished fact.'

Mr Raine said that up till now there had been very little co-operative research effort, and he welcomed the proposed extension of RABRM into plastics. 'In the competitive economy of today,' he said. 'One has to run rather fast even to stand still — and this means continuous research.'

Earlier, Mr Raine had put his finger on two kinds of research — that which innovates and that which maintains the healthy commercial aspect of existing projects.

Innovations were as likely to come from outside the industry as in it. High pressure polythene came by accident from a study of the effect of pressure on chemical reactions, and polystyrene and PVC were both 19th century discoveries. Mr Raine considered that the raw materials suppliers concentrated most of their resources on improving and cheapening existing processes and products.

Research on the machine side had been comparatively neglected, he indicated, and, although it was extremely expensive he warned that the UK was in danger of falling behind if the situation was not dealt with.

Replying to a delegate who asked why undue stress in the UK was made in pursuit of new raw materials at the expense of materials we already have, Mr Raine said that he did not think this was so. 'There are many more established grades flowing from the raw material manufacturer now than there were 15 years ago.'

Other papers delivered were 'Planning and Budgeting in the Plastics Industry,' by R. E. J. Gillett (British Resin Products); 'The Commercial Prospects of the Plastics Industry,' by J. Morrish (Thermo-Plastics Ltd.); 'Recent Technical Developments in Thermoplastics,' by A. B. Glanvill, J. Hartley and S. Squires (Shell Chemical); 'The Outer Seven,' by Dr T. Ward (I.C.I.) and 'Automation and Work Study,' by F. E. Mills (B.I.P. Engineering). Full reports on all these papers will be given in future issues of *RJIP*.

On the evening of October 6 the Federation were the guests of Scarborough Corporation and on October 7 the conference banquet and dance were held. A high spot of these very successful functions was the film which was taken of various activities at the conference and quickly developed and shown at the Federation dance.

Discussing a point before the delivery of the second conference paper—on the commercial prospects for plastics—are *(left to right)* **C. H. Glassey (BIP Chemicals Ltd.), David Radford (BPF chairman), J. Morrish (Thermo-Plastics Ltd.) and F. Walls (BPF vice-chairman)**

Fibres in Industry

Du Pont International SA recently announced in Geneva that sales for industrial applications will be directed by a special section within the textile fibres department.

The head of this new section, James Salmon, joined E. I. du Pont de Nemours in 1948 as a specialist in marketing. Since 1959, he has been with Du Pont International. Mr Salmon recently returned to Geneva from an extended trip to Wilmington, where he reviewed the latest advances in the applications of Du Pont fibres in the industrial world.

Up till now industrial sales have been handled through the regular Du Pont textile channels. 'But because industrial end uses require technological methods not normally found in the production of consumer goods,' Mr Salmon explained, 'we have organized this new section in Geneva which will deal exclusively with industrial applications. The new set-up will assist our sales representatives to the greatest possible extent.'

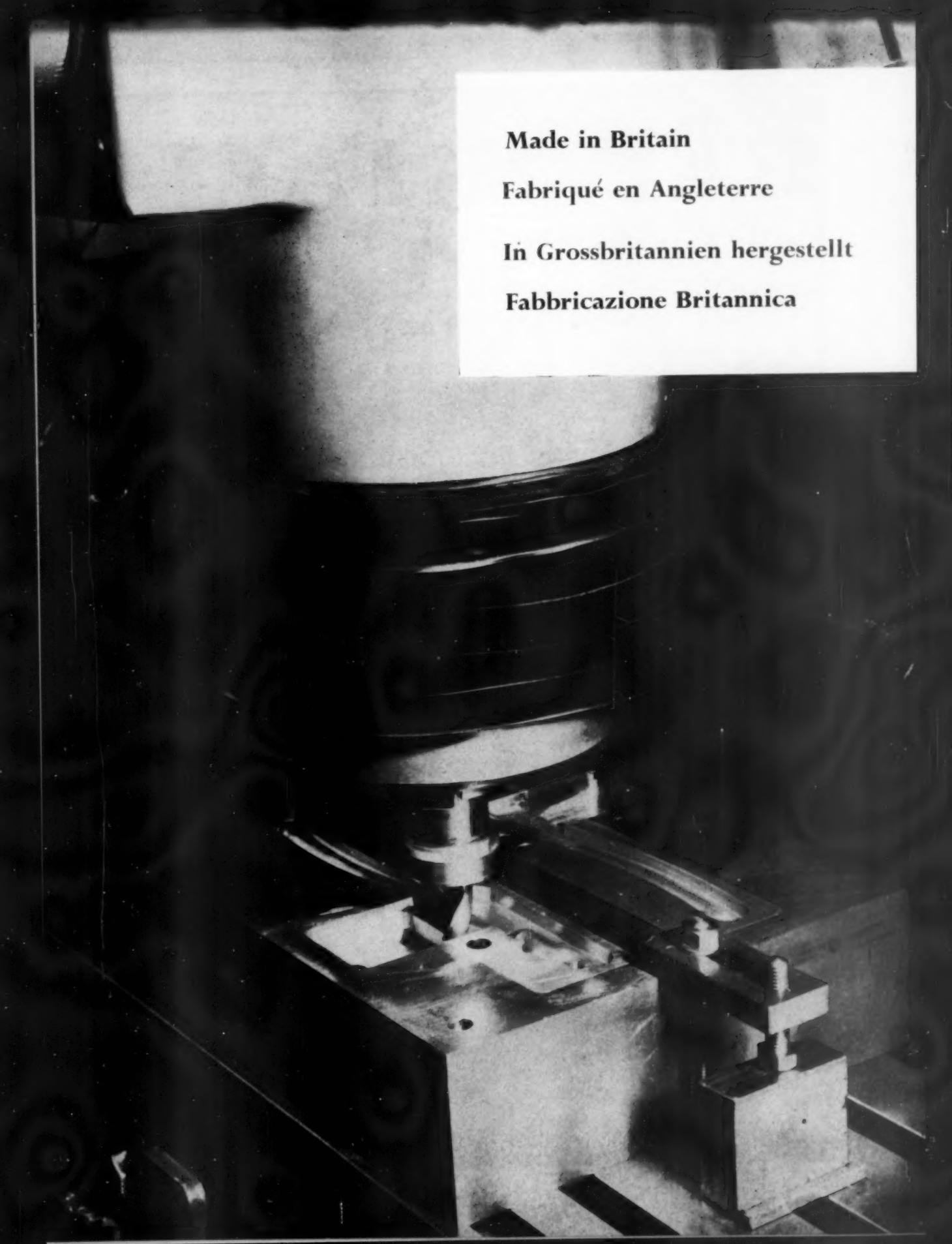
Royal Visit to NB

Queen Elizabeth the Queen Mother is to visit the Castle Mills, Edinburgh, factory of The North British Rubber Company on Wednesday November 2, where she will see the completion of the Scottish firm's £3m. modernization scheme. The Queen Mother will be accompanied by the Lord Provost of Edinburgh, Mr J. Greig Dunbar and the Lady Provost, Mrs Dunbar, and will be received by Mr Foster M. Stewart, managing director and fellow directors. It will be recalled that as Queen she accompanied King George VI on a wartime visit to Castle Mills in March 1941.

Quick Spraying

One US paint company has designed polythene film covers to protect car wheels. This quickens up spray painting time. Due to a special back fold, the covers can be easily draped over each wheel without the usual bother of individual clamping, tying or taping that is necessary with ordinary methods.

Union Carbide polythene printed in three colours has been used.


Made in Britain
Fabriqué en Angleterre
In Grossbritannien hergestellt
Fabbricazione Britannica

mulroy's EXPORTALIA

"WHICH SORT ARE YOU, OUTER SEVEN OR INNER SIX ?"

"—AND NOW GENTLEMEN— THE EXPORT MANAGER'S REPORT"

I WAS QUIETLY READING MY 'DAILY WORKER' IN THE CLUB THE OTHER DAY COMRADE, WHEN.....

"HAVE YOU A CONDOLENCE CARD SUITABLE FOR AN EXPORT MANAGER WHO HASN'T HAD AN ORDER FOR THREE MONTHS?"

"I USED TO BE EXPORT MANAGER OUT HERE - THEN, ONE DAY, I THOUGHT - WHAT THE HELL!"

"FRANKLY SENOR, I HAVE ESTABLISHED A RATHER FAVOURABLE RECIPROCAL ARRANGEMENT ON MY TYRE CONTRACT."

Rubber and Plastics Products Made in Britain

The photograph on page 591 is of one of a range of flexible PVC gaiters recently introduced by Plysu Products Ltd. under the trade name Corrugaiter. Made by a special process of heat sealing, a very high expansion contraction ratio is obtained.

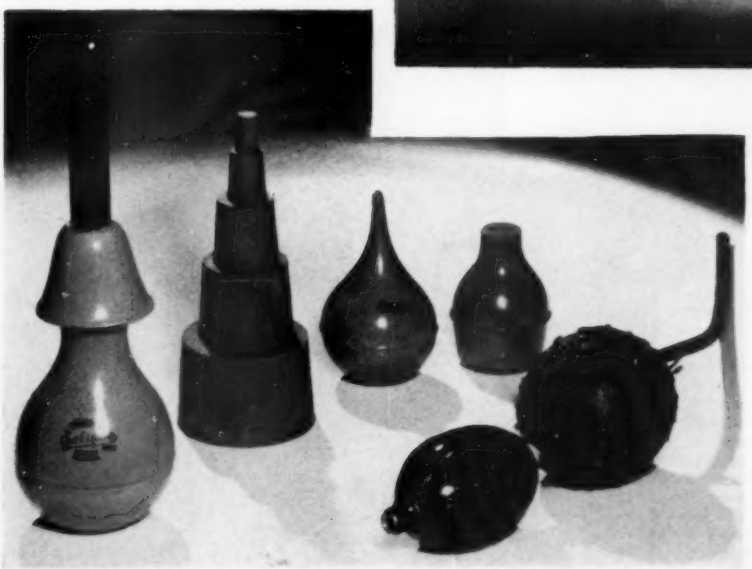
PICTURED on this and the following pages is a representative cross-section of rubber and plastics goods from British manufacturers. The range is comprehensive within the limits of space, but it is, of course, impossible to illustrate more than a fraction of the tremendous variety of products marketed by the British rubber and plastics industries.

IN questa pagina e nelle seguenti si illustra un assortimento svariato medio degli articoli di gomma e di plastica prodotti dai fabbricanti britannici. La gomma è vasta tenendo in conto le limitazioni di spazio disponibile, ma naturalmente è impossibile illustrare più di una piccola parte della enorme varietà di prodotti lanciati sul mercato dalle industrie britanniche della gomma e della plastica.

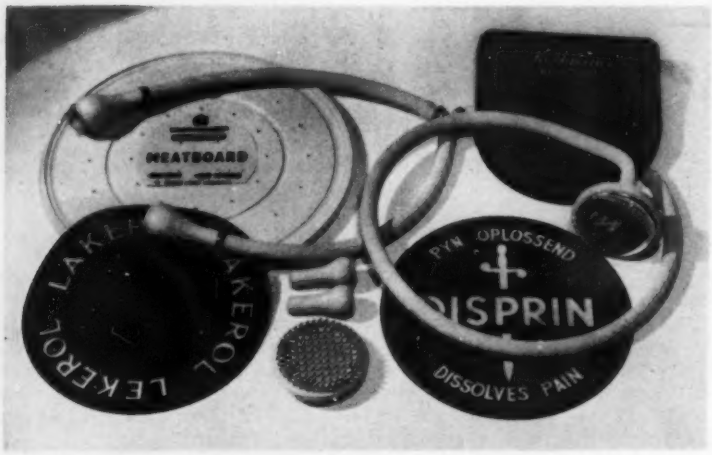
ON verra illustrée sur cette page et les suivantes une tranche représentative des articles en caoutchouc et en matières plastiques de chez les fabricants anglais. La gamme est complète dans les limites de la place disponible, mais il est naturellement impossible d'illustrer plus qu'une fraction de l'énorme diversité des fabrications mises en vente par les industries anglaises du caoutchouc et des plastiques.

DIE Abbildungen auf dieser und den folgenden Seiten geben einen Uberblick über die Erzeugnisse der britischen Kautschuk- und Kunststoffindustrien. Obwohl die Auswahl so reichhaltig getroffen wurde, wie es der verfügbare Raum gestattet, ist es natürlich unmöglich, mehr als einen Bruchteil der ungeheuren Vielfalt von Produkten abzubilden, die von den britischen Kautschuk- und Kunststoffabriken auf den Markt gebracht werden.

In May this year the company held an exhibition on the industrial uses of nylon —the first fully comprehensive review of this field staged in the UK. An enormous number of products were shown, from sutures and sails to containers and conveyor belts. This 'Crewsaver' inflatable nylon dinghy is primarily designed as a tender for small craft. It is big enough to carry two to three people, but deflates into a compact bundle and weighs only 20lb. The man is wearing a Bri-Nylon sailing smock and trousers heavily proofed on the inside with neoprene, while his companion has a lighter weight proofed nylon smock and trousers. **British Nylon Spinners Ltd., 68 Knightsbridge, London, S.W.1.**

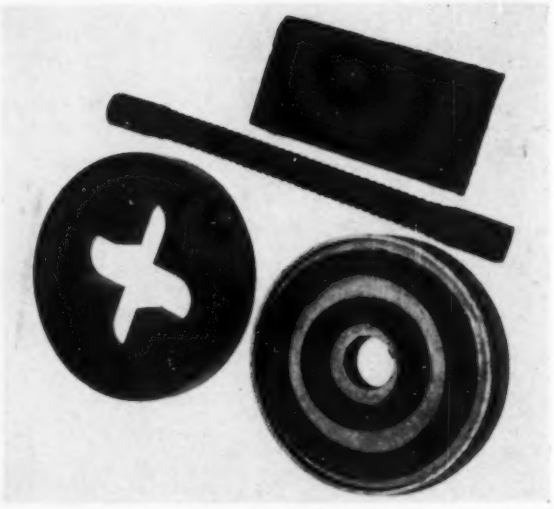


Three of the company's top selling products on the export market are now in fresh packages which have met with a good response. The lines are the 'Perfex' enema, 'Eclipse' whirling spray and 'Omega' breast reliever. In each case the carton is the modern folding type, well designed in blue with the contents clearly shown in white lettering. Other products from this firm include medical lines, laboratory bungs and tubing, resin rubber soling and a variety of mechanical mouldings and extrusions; in this last field the company is planning a rapid expansion. **J. G. Ingram and Son Ltd., The London India Rubber Works, Hackney Wick, London, E.9.**



Redfern advertising mats go on to floors and counters in shops all over the world, carrying the messages of leading advertisers. Also pictured are a shower spray and a meat board. These are just two examples from the company's household range which is distributed to leading wholesalers and stores in overseas markets. **Hunter Hardy Ltd., Dawson Street, Hyde, Cheshire.**

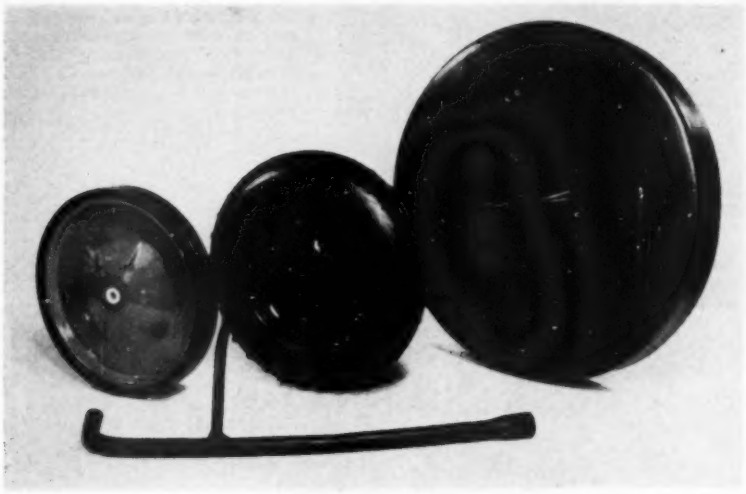
For over a century this company has specialized in the design and production of railway components. Rubber springs of Spencer Moulton design have been successfully adopted by many of the world's leading railways. Other products include vacuum brake hosepipes and cylinder components, steam heating and airbrake hosepipes. **George Spencer Moulton & Co. Ltd., Bradford-on-Avon, Wiltshire.**

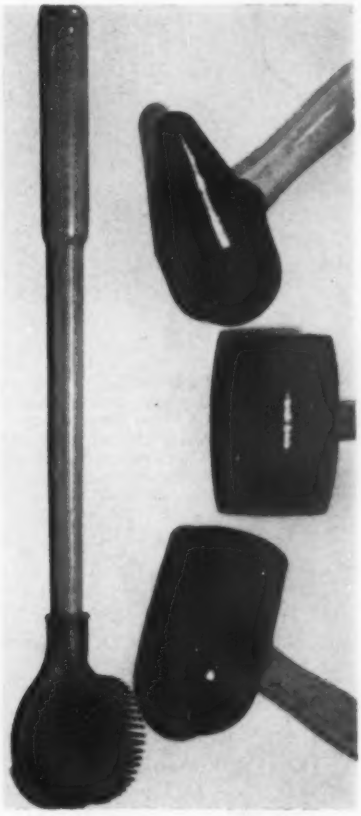


Bathing caps are usually much less glamorous than bathing suits—but here's an exception: 'Petal', from Richborough's wide range. This gives a choice of over 50 designs and colour combinations. **Richborough Rubber Works Ltd., Sandwich, Kent.**

Pictured are a few specimens of the many types of moulded unit soles produced for the footwear industry. There are resin rubber units for ladies' casual footwear, walled units for bootees and sponge soles for slippers. These latter items are in addition to the various unvulcanized compounds, which are supplied for use in the direct moulded method of production. **Boro Rubber Co. (1912) Ltd., Para Rubber Works, Smithy Bridge, Littleborough, Lancs.**

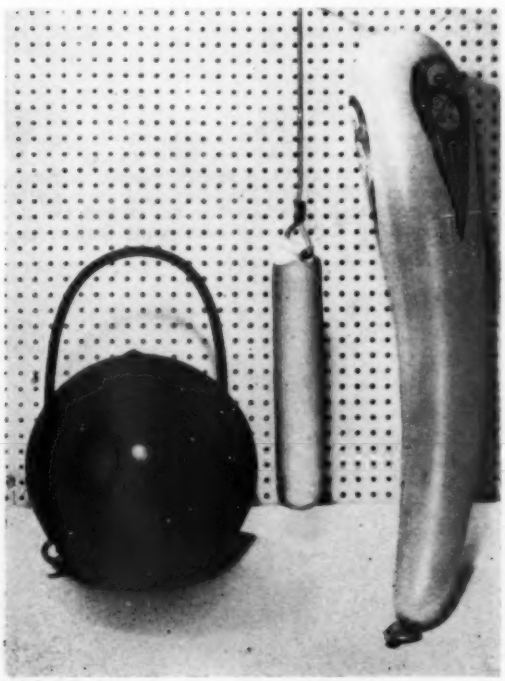
Russells Rubber specializes in all types of extrusions, formed surrounds and gaskets made to customers' requirements. Items of note are the solid rubber wheels and dustbin lids pictured here, fine and fluted matting in lengths of approximately 40ft. and rubber fenders for protection of light sailing craft and industrial trucks. Shaped hose connections for domestic appliances, automobiles and industrial engines are another specialist product. Cotton and synthetic fabrics are coated with various natural and synthetic rubbers to make products used in the chemical trades. **Russells Rubber Co. Ltd., Capewell Works, Wellington, Shropshire.**



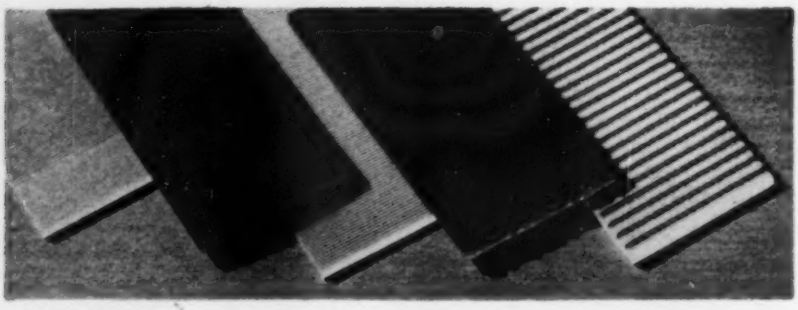


Among the many products manufactured under the trademark Puck, balloons and balloon pumps have become world-famous. Typical of the wide range of ideas, packs, shapes and sizes are the Puck space ship and ring balloons. The space ship shown, printed on both sides with an illustration of a spaceman in his cabin, inflates to 3ft. in length and from take-off to landing flies a distance of 150ft. The plastic range has been greatly extended and now includes equipment for yacht, dinghy and sailing enthusiasts all over the world. Vinyl plastic 8in. and 10in. mooring buoys, tough plastic fenders—both pictured—and rescue floats are amongst the new additions. **Grovewell Ltd., 656 Forest Road, London, E.17.**

Rubber-headed mallets, made in 7 sizes, and from 3oz. to 3lb. in weight are among Parlatex Ltd.'s export lines. These mallets have either hard or soft faces. The Sanibrush lavatory brush shown is made in pastel shades of pink, blue and green, with a 13-in. handle to match. The company's Batco tap washers are used by leading water boards and tap manufacturers, and are suitable for either hot or cold water. Recently introduced is the 'Flexirive,' a rubber rivet made from $\frac{1}{16}$in. diameter upwards. These have been designed to join two articles together quickly and in a slightly flexible manner. Also manufactured is a wide range of moulded industrial articles in both natural and synthetic rubber. **Parlatex Ltd., Highbridge, Somerset.**



This year the Marigold new style household rubber gloves, with crepe exterior and suedette inner lining, were launched in the domestic market supported by extensive television advertising. Their novel feature is extra long fluted cuffs which stay up while in use. They are presented in an attractively re-styled window carton, printed in the familiar marigold colours, and are available in a full range of sizes from 6½ to 10 rising by half sizes. The glove has also been introduced into a number of export markets at the beginning of 1960 and sales in a number of West European markets are being strongly supported by consumer advertising. **J. Allen Rubber Co. Ltd., Whitecroft, Lydney, Gloucestershire.**

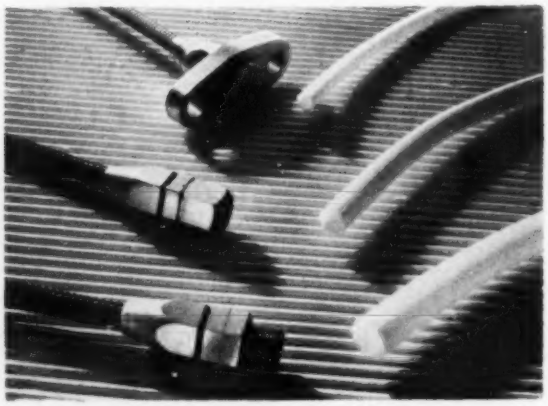


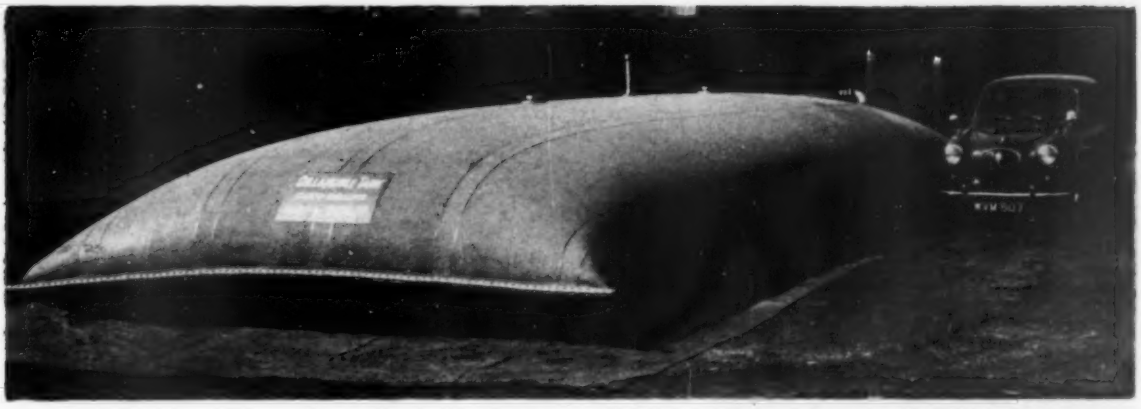
The solings illustrated are (left to right) wave line, fine wave line, both in gum rubber, very fine fluted, corrugated crepe pattern and Solway sheeting strip. The gum material is popular now—its lightness and flexibility being suitable for many modern shoe lines. The three latter solings and the wave line in the company's Conway material are easy to work in manufacture and have good hard-wearing qualities. **The Harboro' Rubber Co. Ltd., Dainite Mills, Market Harborough.**

The company, one of the first—and now one of the biggest—plastics firms in the UK, markets a very wide range of materials, including PVC and polythene flexible sheet and layflat; polystyrene, nylon and ethyl cellulose moulding powders; Saran filament and a variety of plastics in the form of rigid sheet and film. Illustrated is a fume removal fan made by Tanks and Linings Ltd., from Cobex —rigid vinyl sheet—laminated with expanded metal. **BX Plastics Ltd., Higham Station Avenue, London, E.4.**

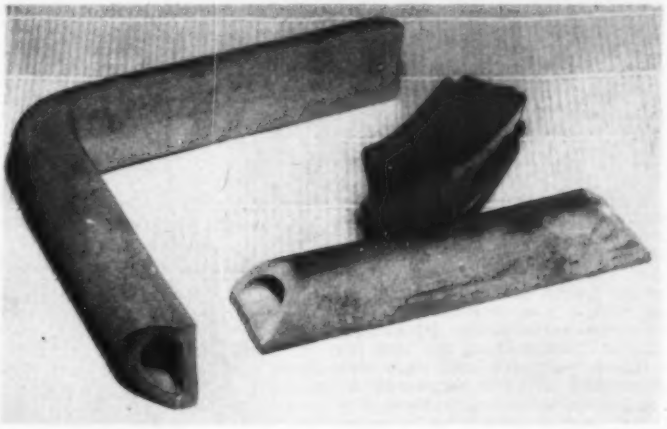
This old-established company offer a selection of high-quality soling and heeling materials, including the latest resin-rubber units. Also manufactured is a range of sponge rubber balls from 1in. to 2½in. diameter and sheetings for both footwear and cap peak industries. **Shockstop Rubber Products Ltd., Audenshaw, nr. Manchester.**

PTFE flexible hoses manufactured by the company have a wide temperature range (—90° to 250°C.) and high working pressures. For example, on a ¼-in. bore hose a working pressure of 5,000 psi can be achieved. The flexing qualities are illustrated by the fact that on certain steam presses PTFE flexible tubing has made well over a million and a quarter movements without any measurable effect. The low coefficient of friction means that the hose is virtually self-lubricating, and it is resistant to most chemicals. Fittings illustrated are a swivelling re-usable gauge unit, a patented re-usable female union (cane seat pattern) and a patented re-usable fixed male. **William Rose Ltd., Hilyn Works, Lockfield Avenue, Brimsdown, Enfield, Middlesex.**





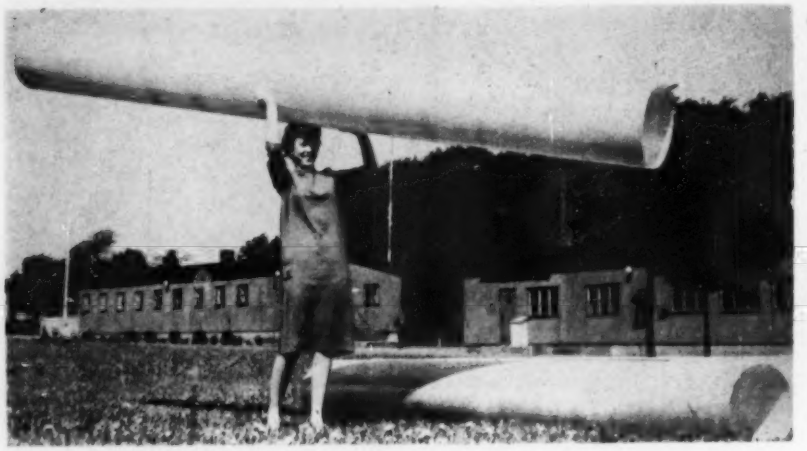
Collapsible containers made of rubber reinforced with nylon are now being produced by the company for the conveyance and storage of liquids in bulk. The fabric is coated on one side with neoprene and on the other with a variety of natural, sweetened or synthetic rubbers according to the liquid to be carried. Since they are flat when empty, in liquid haulage they can be rolled up easily and strapped to the cab of a lorry. For these purposes containers are available in standard capacities of 250, 500, 800 and 1,000 gallons, and can be made to specification. Static storage on contract sites and desert areas (50,000 gallon capacity containers are made for this) is another application. **Dunlop Rubber Company Ltd., General Rubber Goods Division, Cambridge Street, Manchester, 1.**



Brammer fenders, moulded in D-section, are designed to cushion impact and absorb shock. Being white rubber, they do not mark any object striking them. They are supplied in 55-ft. (16.8 metres) lengths or three sizes of corner pieces shaped and punched for easy fitting. The company's cloche holders, not shown, are designed to take ⅛in. (0.3cm.) glass. No metal parts are needed with these virtually indestructible holders. **H. Brammer and Co. Ltd., Hudson Road, Leeds, 9.**

The aprons on these appliance trucks are made of industrial Rubazote, ½in. (1.27cm.) thick. This comes into direct contact with goods and prevents chafing or marking during transportation. The trucks are manufactured by H. C. Slingsby Ltd. The closed cell structure of Rubazote, a form of expanded rubber, is extremely resilient; greatly increases the cushioning effect. **Expanded Rubber Co. Ltd., Mitcham Road, Croydon, Surrey.**

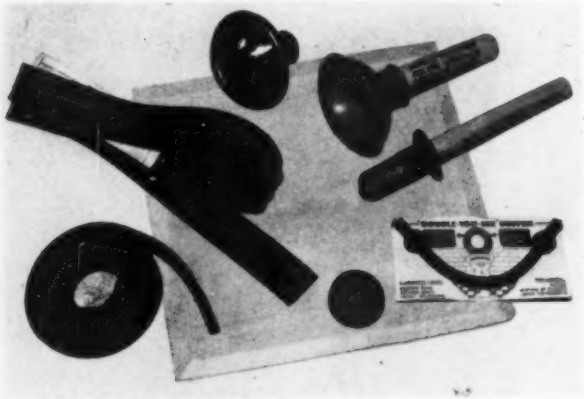
Penfold golf balls, in the British and American sizes, are renowned throughout the world for their consistent performance and high quality. The new Penfold golf gloves are manufactured from the finest leather obtainable and have gained distinction in their particular sphere. **Golf Ball Developments Ltd., Bromford Lane, Ward End, Birmingham, 8.**



Flexo Plastic Industries recently acquired the British manufacturing rights for a patented method of fabricating glass - fibre - reinforced polyester pipes and ductings. They are producing pipes with bore dimensions from 1¼in. to 20in., in lengths up to 40ft. without joints. The wall thickness of the material can be varied between ⅛in. and ¼in. Their chemical resistance is well known, and the high strength/weight ratio is indicated in the picture. By variation of weaves of glass fabric—square weave, satin weave, unilateral weave—pipes can be designed to give major strength characteristics to suit specific applications. Applications include ventilation ducting in mines and factories and pipework in chemical plants. **Flexo Plastics Industries Ltd., South Chingford, London, E.4.**

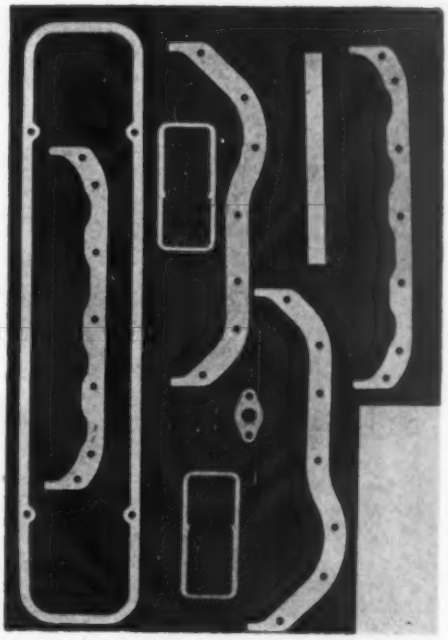
Easykleen products shown in the picture are a rubber watering can rose, a force cup and a rubber mat. Also illustrated are a Busy-Body rubber stove cleaner, a Poppin towel holder (at the bottom, and in the middle of, the mat), a lavatory buffer and Bux-Strip senior and junior draught excluders. The watering can rose has a rubber body and solid copper jet plate, which can easily be removed for cleaning and just as easily refitted. The Poppin towel and article holder can be fixed, without tools, on doors, edges of shelves or underneath shelves, and will hold anything from a towel to a broomstick. **B. and W. Patents Ltd., Tillgray Works, Booth's Hill Road, Lymm, nr. Warrington.**

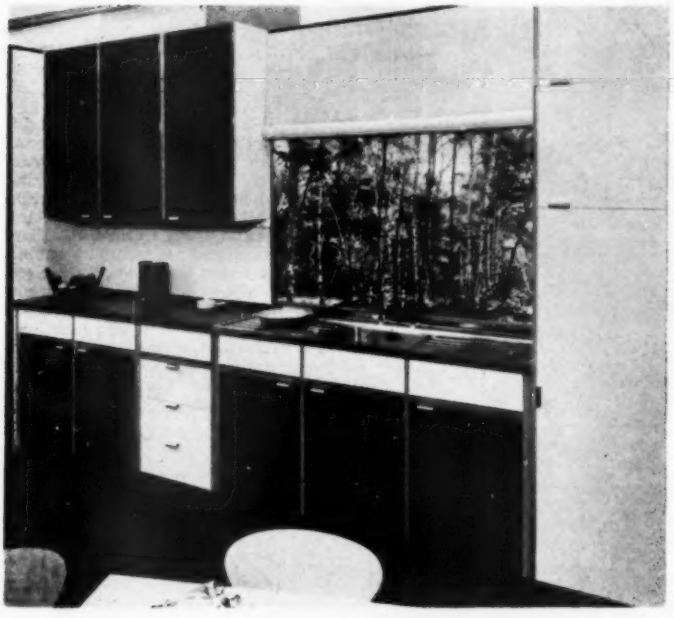
The Forsum and Blue Spot golf balls are two of Sparkbrook's best known lines. Although the company is mainly concerned with manufacturing golf balls and clubs, captive and parachute balls are also produced. Another speciality is the production of golf balls branded with the customer's own name. **Sparkbrook Golf Ball Co. Ltd., 295 Highgate Road, Sparkbrook, Birmingham 12.**



Greengate and Irwell, one of the UK's biggest rubber manufacturers, who produce a very wide range, is making a special boot for electricity boards and as an attachment to diving suits. Safety is the keynote, as the boots are used in connexion with heavy-duty cables and, underwater, in the erection of port installations at considerable depth. Reinforced-fabric-lined throughout, the boot has a grade 1 BSI specification 953 steel toe cap. **Greengate and Irwell Rubber Co. Ltd., Greengate Works, Manchester 3.**

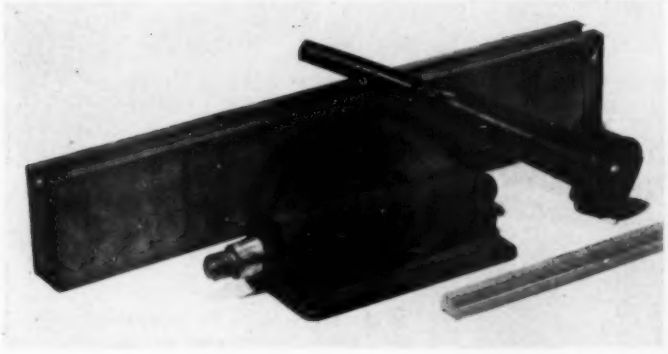
These gaskets have been cut from a cork/rubber material, which is made—using Hycar synthetic rubber—by British Technical Cork Products Ltd. Since the material is completely impervious to grease, it can be used in a variety of engineering applications. **British Geon Ltd., Devonshire House, Piccadilly, London, W.1.**



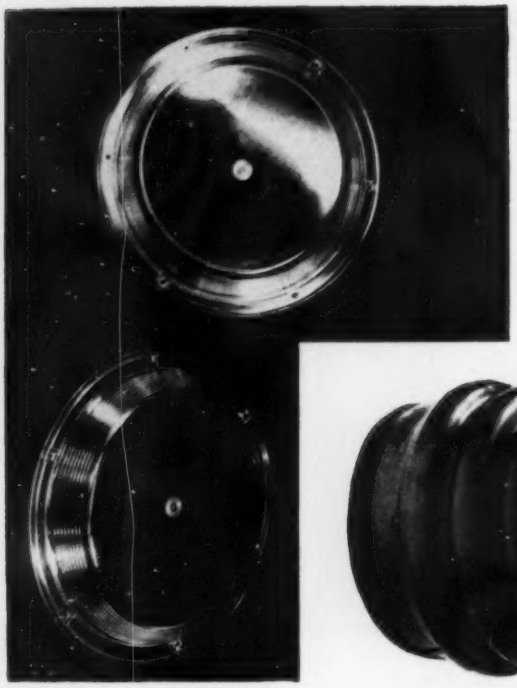


Distinctive feature of this ' Californian Kitchen ' is the use of Formica Beautyboard with a dark woodgrain effect for the cupboard doors. The material is a constructional board with a core of tropical woods and a decorative front of laminated plastic. The counter is in Formica's satin black. **Formica Ltd., De La Rue House, 84 Regent Street, London, W.1.**

The ' Cure-C-Cure ' process of repairing tubes and tyres was developed by the company to give the security of vulcanization without the use of heat. There are outfits for every type of vehicle, from tractors, commercial transport and cars to scooters, mopeds and cycles. As well as patches the range includes valves, tyre plasters, garage and workshop outfits, etc. The process has proved its complete reliability throughout the world. **Romac Industries Ltd., The Hyde, London, N.W.9.**

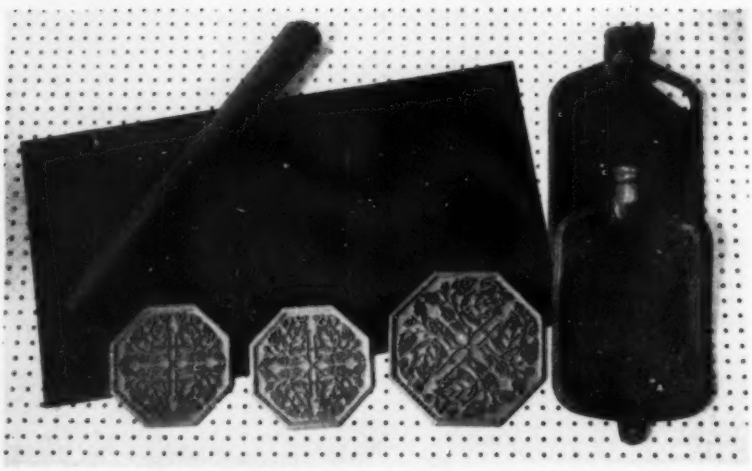


The company produces a variety of rubber components mainly to individual specification for the motor, aircraft, domestic machinery and other industries. A few of these items are illustrated together with an example milking machine inflation and a rice mill brake block, both of which Avon produce in large numbers. Flexitors and other springs for all types of vehicles are a speciality. **Avon India Rubber Co. Ltd., Industrial Rubber Products Division, Melksham, Wiltshire.**

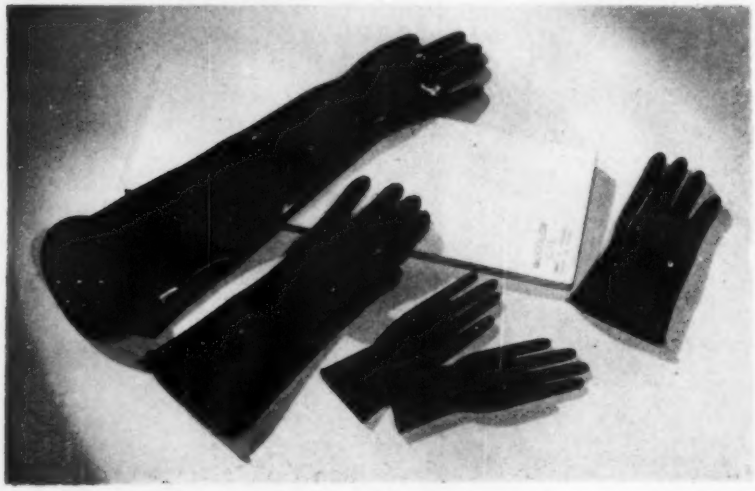


Illustrated is the door lens which the Plastics Division of the company is moulding for Parnall (Yate) Ltd. It forms an integral part of the new Parnall TD.59 de luxe auto-dry electric tumbler dryer. The application is particularly interesting as blue-tinted transparent styrene acrylonitrile material has been used to replace the customary glass door with a cast metal bezel, with consequent saving in weight and in price. Facets on the surround give a decorative touch to the door. **Universal Metal Products Ltd. (U.M.P.), Salford, Lancs.**

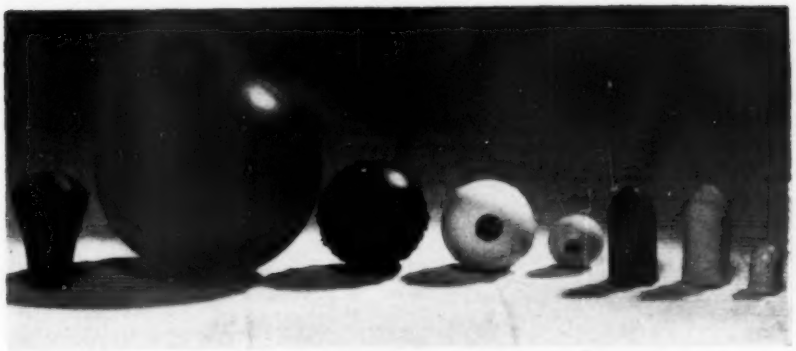
Moulded rubber components in natural and synthetic rubber; convoluted and shaped hoses; vacuum brake, air brake and steaming heating hose; traction motor ventilating bellows, rail chair pads, etc., are among the company's products. They are made in natural or synthetic rubber according to duties involved. When exceptionally high resistance to tearing, abrasion and impact is required, components, as the bellows shown here, can be manufactured in 'Prescollan,' the John Bull polyurethane rubber. **John Bull Rubber Company Ltd. (Mechanical Products Division), Evington Valley Mills, Leicester.**



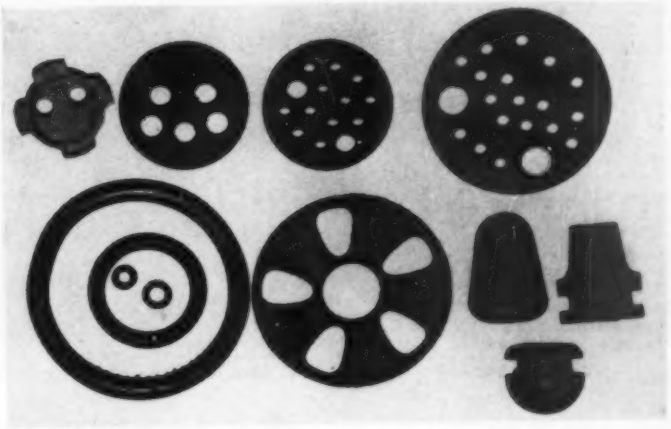
Rubber housewares manufactured by the company include the famous Suba Seal hot water bottles and the new Suba Flora bottles which incorporate a perfume as an integral ingredient of the actual rubber. Suba Maid housewares kitchen sets comprise draining mat, sink mat and sink edge protector, all in gay colours. The octagonal table mats come in many colours and there are mats for cars, caravans and the home. **William Freeman and Co. Ltd., Subaseal Works, Barnsley.**



Specialists in the manufacture of rubber gloves, Veedip—and their associated company Lewis Gilder—produce a glove to meet every possible application. Four types are illustrated: a surgeon's glove; an industrial gauntlet, crepe-reinforced and acid resistant; a grey abrasion resistant industrial glove; and a gauntlet in neoprene which is supplied to atomic research establishments. The company also manufactures an expanded polystyrene called Isocolor for insulation purposes. **Veedip Ltd., Farnburn Avenue, Slough, Bucks.**



The company are primarily manufacturers of rubber bands, and their trade name Mermaid has been pre-eminent for nearly 40 years. Less well known under this trade mark are the products shown in our illustration and manufacturers of contemporary wire work, show cases, furniture and the manifold list of articles calling for rubber feet will be interested to know that moulds for a wide variety of sizes and shapes are held against the need of manufacturers at home and abroad. **Caton Ltd., Mermaid House, 70 St. Thomas Street, London, S.E.1.**



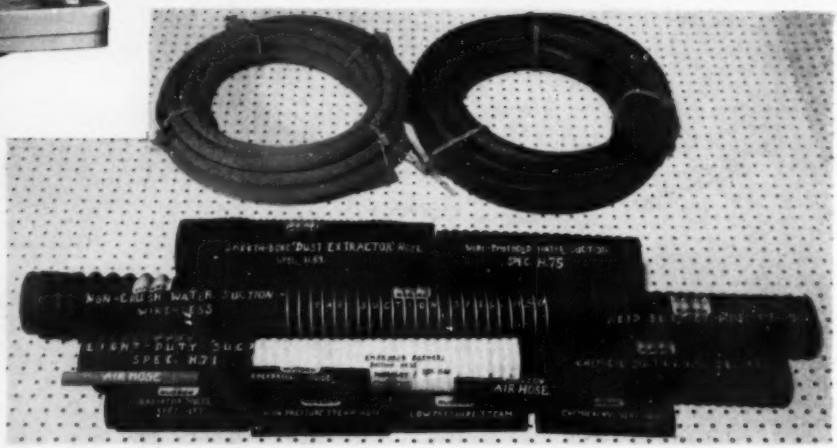
Typical mouldings in various synthetic rubber are shown. The company specialize in all types of rubber components to precision limits. These include 'O' ring seals, sleeves, bushes, diaphragms, aircraft electrical components, extrusions and rubber to metal bonded parts. They are made in a range of compounds from natural and synthetic rubbers including silicone rubber and Viton. **Precision Rubbers Ltd., Bagworth, Leicester.**

These pressure-vulcanized men's knee-length boots represent an interesting technical development by the company. The boots are identical except that one is made from conventional compounded rubber in black, one is made from translucent gristle rubber, while the third boot is white and the fourth in olive green. **Futura Footwear Ltd., Quarry Street Mills, Stalybridge.**

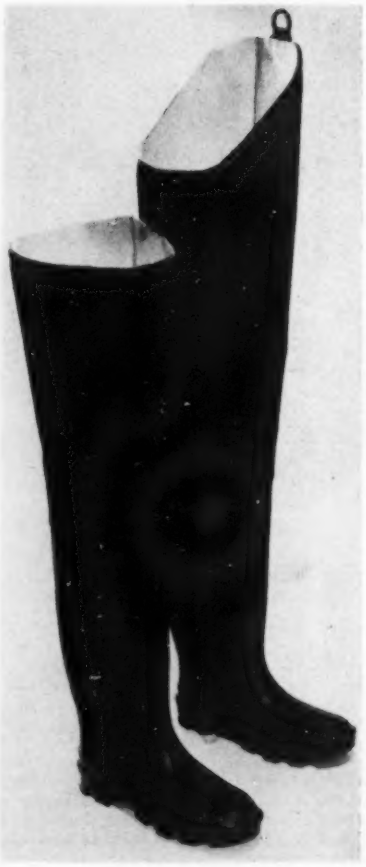
The Dunlop RS 5 high-speed tyre, introduced earlier this year, has a specially designed safety shoulder that is said to give 'remarkable steering precision.' Incorporated by new manufacturing techniques are 3,000 knife cuts which give full traction across the tread width. The nylon casing gives strength and resistance to the high temperatures developed at sustained speeds of 120mph. **The Dunlop Rubber Co. Ltd., Fort Dunlop, Birmingham.**

This company specializes in the design and manufacture of anti-vibration mountings, flexible bearings, flexible couplings and rubber suspension for road and rail vehicles. The 'Cushymount' illustrated is for large oil engines; it provides deflections of 0.5in. for loads between 1 and 5 tons. Another mounting—the 'Metacone'—for lighter oil engines, is equally effective for insulating vehicle bodies and cabs from vibration. **Metalastik Ltd., Evington Valley Road, Leicester.**

The standard range of Moseley hose covers almost every industrial requirement: oil suction and discharge hose up to 12in. bore; petrol delivery hose for tankers; chemical suction and delivery hose; air, water, coal cutter, rockdrill, brewers, antimonial, oxyacetylene, sandblast, steam, spray, radiator, sand and gravel are all examples from the company's range. A recent extension to the hose department has led to the production of Moseley long-length hose for water, air, oxyacetylene, solvents, petrol, first aid and chemicals. Other products include PVC conveyor belting, plastics piping, roller covers, elastic thread, sheet rubber, mouldings and extrusions. **David Moseley and Sons Ltd., Chapelfield Works, Ardwick, Manchester.**

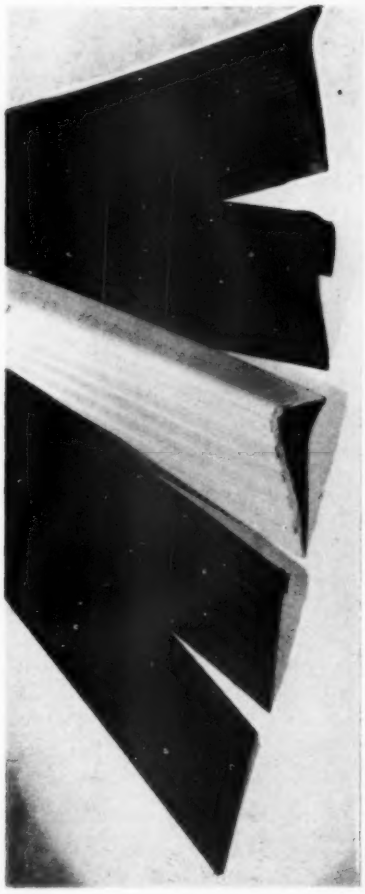


Resnit is a recent development in the field of reinforced plastics first made available last year; it consists essentially of a resin-impregnated fabric and is supplied in the form of dry semi-rigid sheets which can be formed under heat and moderate pressure to make reinforced plastic components of complex shape. It is claimed that the material is suitable for mass production at a relatively low cost. A variety of products are already being manufactured with it, including this Revelation suit-case. **Leicester, Lovell & Co. Ltd., St. Christopher's Works, North Baddesley, nr. Southampton.**



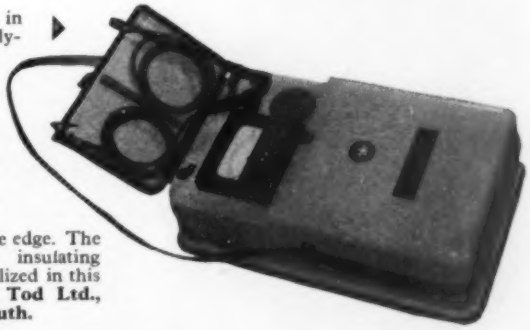
Avon Stonehenge, a seamless moulded and lined boot, is now produced in four types: short, knee, three-quarter thigh and full thigh lengths. Men's single sizes 6-11. In the company's range of man-made soling materials are: Nuberlite and Royal Nuberlite resin solings; Nubersole and Novalite microcellular solings and Mannide sandal units. Avon also specialise as independent suppliers of compounds, adhesives and technical service for all types of moulded footwear and moulding machinery in the direct vulcanization process. **Avon Footwear Sales Ltd., Bridgend, Glam.**

Among the wide range of products that come from this company are the rubber coverings and nosings shown. They are manufactured in a variety of colours and profiles. The company provides a complete compound supply service for the rubber and plastic industries. **Phoenix Rubber Co. Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks.**



Part of this company's comprehensive range of swimming caps, under-water gear, hot water bottles and electric plugs and sockets is shown. The Submarine range of swimming caps includes several types of cap and various designs, all available in eight attractive colours. The Trident cap with internal suction cups is illustrated, together with samples from the Clipper line of underwater gear: swimming flippers, underwater mask, combined mask and tube and goggles. These are available in four colours and all normal sizes. Submarine hot-water bottles are also made in four colours: the Safetyray is pictured. The Duraplug range of unbreakable rubber plugs and sockets covers all commonly used terminal devices, in addition to the cable coupler and connecting socket shown.
W. W. Haffenden Ltd., Richborough Rubber Works, Sandwich, Kent.

This casing, moulded in glass fibre reinforced polyester resin, is used to house Westinghouse track circuit meters supplied to British Railways. These meters are for testing electric signalling circuits. The base is a separate moulding, secured in position by rubber channelling all round the edge. The excellent electrical insulating qualities of GRP are utilized in this application. **W. & J. Tod Ltd., Ferrybridge, Weymouth.**



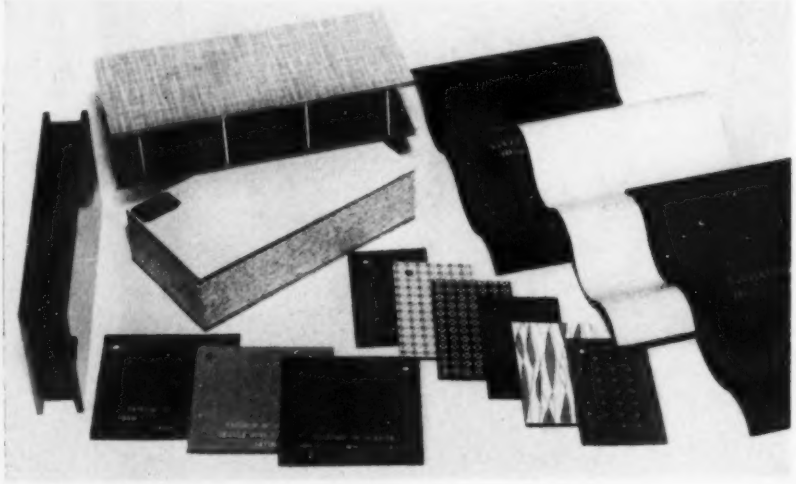
All the garments in the Dannimac collection, including these two new coats styled for autumn, are available for export. The smart white coat on the left is made from I.C.I. Vynide. It is single-breasted, has a soft shoulder line, is satin-lined and the collar is in beaver lamb. It ves in white, green, caramel and ge with a black collar. Sizes, 42in.-47in. (lengths). Wholesale price, approx. £6 6s. 2d. Retail price, approx. £7 19s. 6d. The other coat is one of a range of five reversible garments in the Dannimac waterproof autumn collection known as the turntable range. It is made in plain wool, reversing to checked wool interlined with rubber. Sizes, 42in.-47in. (lengths). There are three colour combinations: green/green, cream, black; royal/royal, cream, black; turquoise/turquoise, cream, black. Wholesale price, approx. £6 6s. 2d. Retail price, approx. £7 19s. 6d. **Dannimac Ltd., 221/3, Oxford Street, London, W.1.**

Acting as air cushion roller bearings, these Sea-Esta Rolla-a-Boats take the hard work out of launching. This 14-ft. dinghy is being handled by three children. The Rolla-a-Boats may also be used as buoyancy bags or as fenders (buoyancy 90lb.). Inflated length is 45in. (114cm.). Approximate diameter is 9in. (23 cm.), and circumference is 30in. (76m.). The company is also famous for its Sea-Esta beds, the newest of which, the Sea-Esta Super Sid d Superb, has box walls, which add to comfort and prevent any possibility of rolling off. **George MacLellan and Co. Ltd., Shuna Street, Maryhill, Glasgow, N.W.**

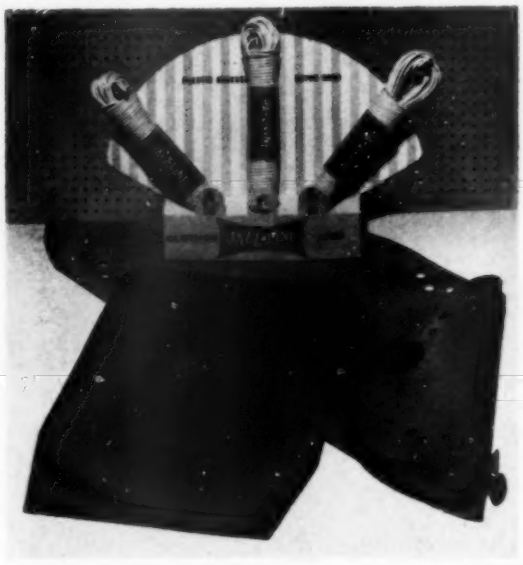
Light to carry and quiet to use, this coal hod is just one example from the wide range of mouldings produced by the company. Made from polythene with an inset metal shute, it has a bail-type carrying handle and is manufactured in four colours. **Fraser and Glass, Woodside Lane, London, W.12.**

The footwear division of the company makes stylish yet waterproof rain boots aptly called Weatherbeaters. This pull-on rubber bootee is called Toptown and the range is black, white and oat, sizes 3-8. Price 22s. 9d. **Dunlop Rubber Co., Footwear Division.**

The company has three main groups of products: flat sheets, corrugated sheets, structural panels. In addition to the laminated plastic products, there are two types of panel having different characteristics and of different basic materials. Decorplast is a decorative laminated plastic with an exceptionally hard-wearing protective melamine surface. The same melamine surface can be had on structural panels, but in different colours and patterns. Chequerplast is a flat sheet with an embossed face suitable for many industrial uses, it is hard wearing and has a high resistance to chemical corrosion. The corrugated sheets are available in two colours and with stove-enamelled finishes. The company's structural panels are all 1¼in. thick. They are available in many finishes and, according to type, are used inside and out. **Holoplast Ltd., 2 Caxton Street, London, S.W.1.**

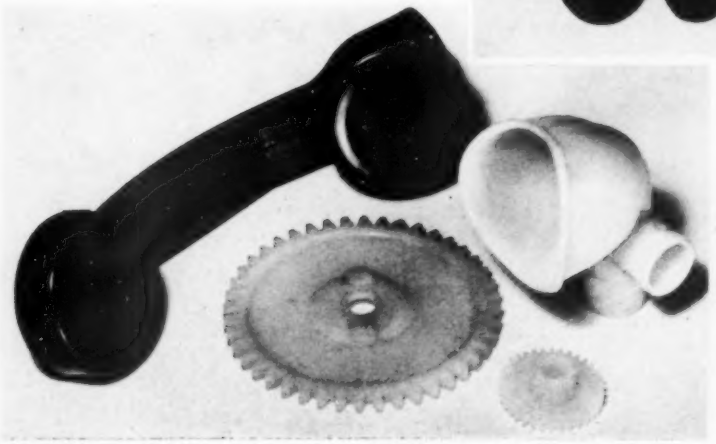


Bendy toys, practically unbreakable, soft and pliable, excite the imagination with the many poses into which they can be bent. Bendability is achieved by a wire moulded into foam rubber, in bright colours readily washable. Items, some of them shown here, include Huckleberry Hound, Mannequin Doll, Lamb, Riding Figures, and the latest fascinating Bendy innovation, Bendikit, which comprises three complete Bendy toys with parts easily interchangeable. **Newfeld Ltd., Newfoam Works, Spelthorne Lane, Ashford, Middlesex.**



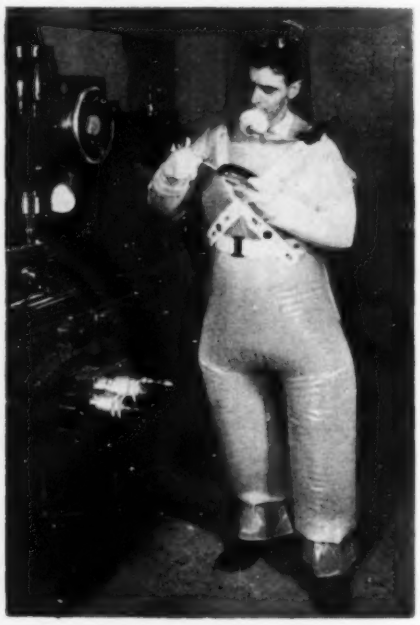
With the introduction of colours into the home, and particularly into the kitchen, Croydex have met the demand for modern colours in rubber draining board mats, sink mats and bath mats, and even the washing department has gone gay with the new introduction of Jazz-Line; this is a plastic-covered rayon cord clothes line, in various strips, which is catching the housewife's eye. **The New Croydon Rubber Co. Ltd., 36 Mitcham Lane, Streatham, London, S.W.16.**

Products of this company, which are exported all over the world, include, for the footwear industry: solid and sponge rubber compounds for direct vulcanization process, soling sheets in natural and resin rubber, unit-, long- and half soles and heels and phenolic top-piecing. Mechanical lines include gaiters, gaskets, airbags and engine mountings. Also manufactured are mats, flooring and tiles. **Perrite Ltd., Weldbank Rubber Mills, Chorley, Lancs.**



Nylon materials, presenting as they do certain difficulties in production, can be made to produce extremely efficient products if carefully moulded. Samples of products illustrated are gears, nasal inhalers and field telephones. Others range from packing glands to bobbins and piston rings. **Lustroid Ltd., Southdown Works, Kingston Road, Raynes Park, London, S.W.20.**

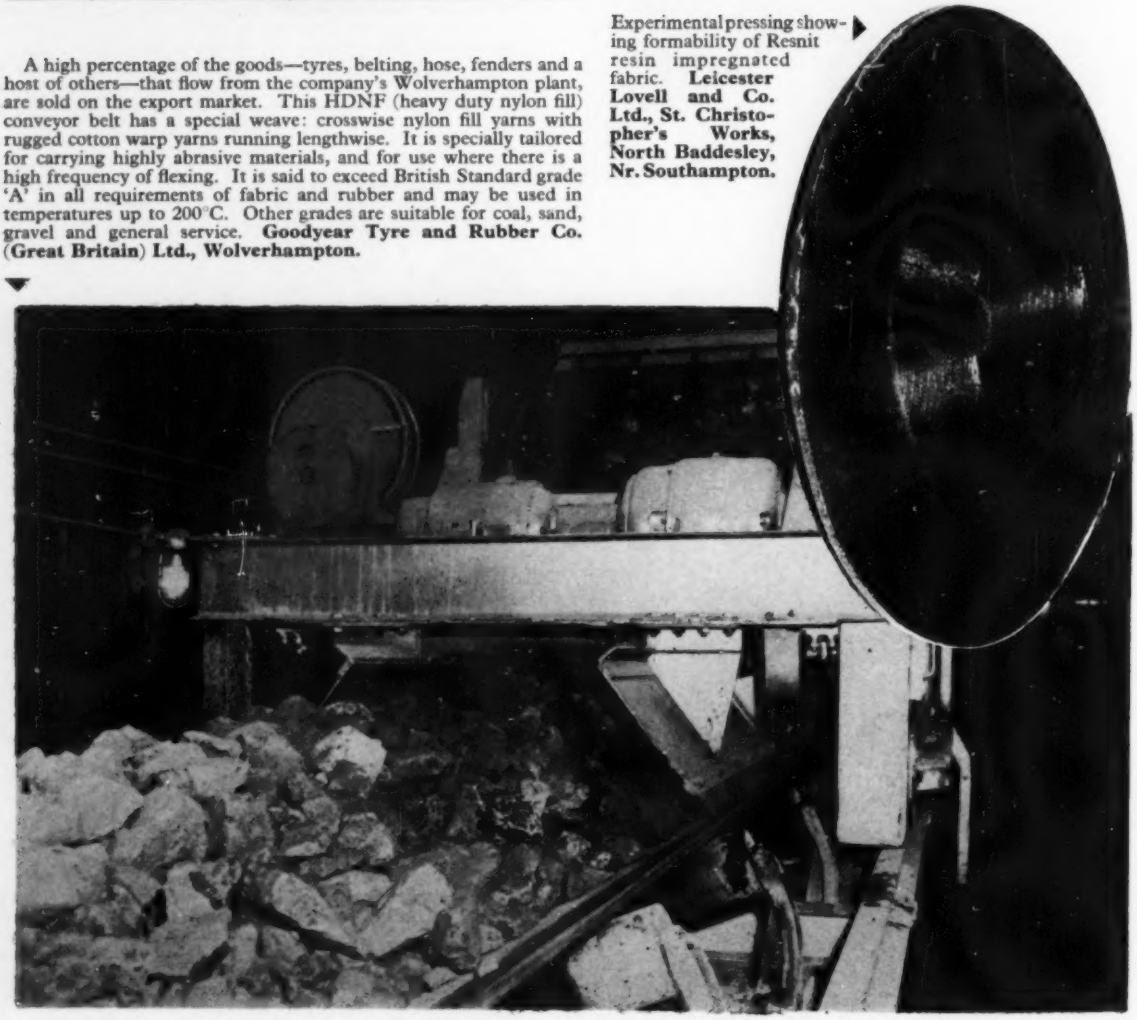
The past few years has seen considerable development in PVC pressure ventilated suits and hoods. They were first developed by Plysu Products Ltd. for the United Kingdom Atomic Energy Authority and designed to provide light, comfortable and inexpensive protection from radioactive dust. This form of protection against airborne contamination is now being increasingly used in industry. **Plysu Products Ltd., Woburn Sands, Bletchley, Bucks.**

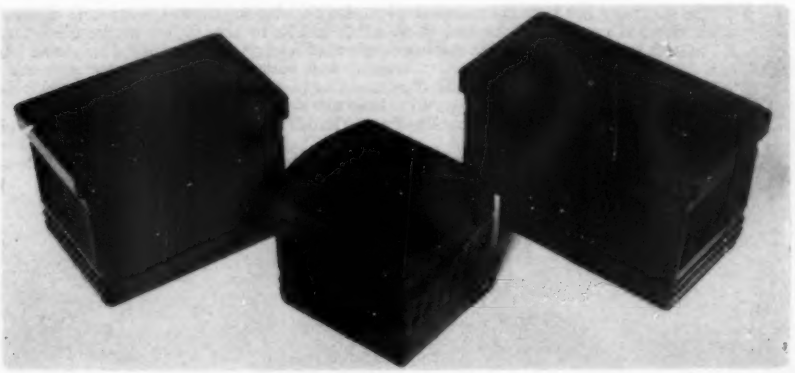


These latex seamless safety and safety plus boots by Dunlop, are now available with an external steel toe cap. They have passed the BSI Grade I test involving an impact of 150ft./lb. The boots provide maximum protection against scuffing and abrasion with an oil and heat resisting sole and heel. **Dunlop Footwear Ltd., Speke, Liverpool 19.**

A high percentage of the goods—tyres, belting, hose, fenders and a host of others—that flow from the company's Wolverhampton plant, are sold on the export market. This HDNF (heavy duty nylon fill) conveyor belt has a special weave: crosswise nylon fill yarns with rugged cotton warp yarns running lengthwise. It is specially tailored for carrying highly abrasive materials, and for use where there is a high frequency of flexing. It is said to exceed British Standard grade 'A' in all requirements of fabric and rubber and may be used in temperatures up to 200°C. Other grades are suitable for coal, sand, gravel and general service. **Goodyear Tyre and Rubber Co. (Great Britain) Ltd., Wolverhampton.**

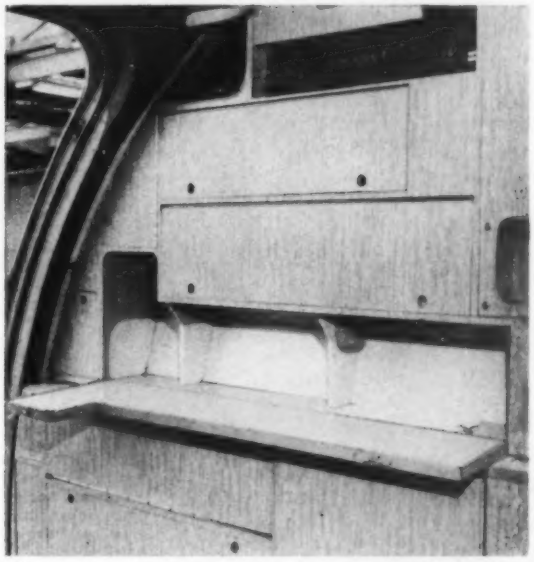
Experimental pressing showing formability of Resnit resin impregnated fabric. **Leicester Lovell and Co. Ltd., St. Christopher's Works, North Baddesley, Nr. Southampton.**





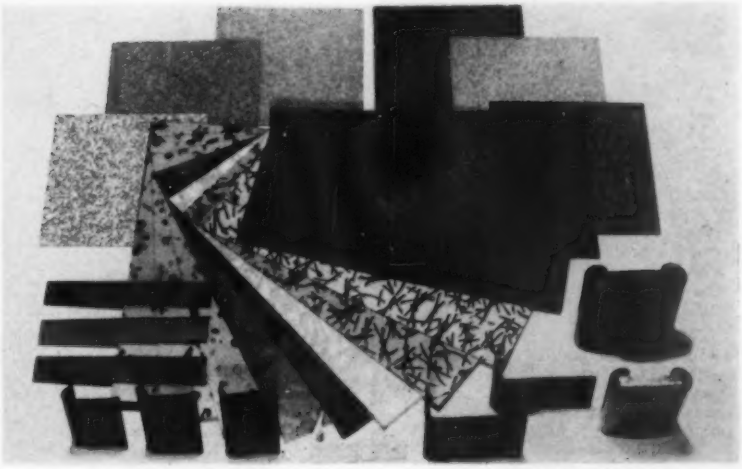
The company manufactures 16 different types of battery boxes in hard rubber. The two 12-volt models illustrated are the most popular in the range, being used in the Austin, Chevrolet, Commer, Ford, Hillman, Humber, Jaguar, M.G., Morris, Rover, Standard, Vauxhall and Wolseley. Although the six-volt circuit is not now generally employed on British cars, there is still a brisk demand for six-volt replacement batteries. The battery boxes are available for export to any country. **National Plastics (Sales) Ltd., Avenue Works, Walthamstow Avenue, London, E.4.**

This Wembley football is one of a wide range of sports balls and play balls in the Mettoy vinyl range. The regulation ones have an authentic look and feel about them and are used by many professional teams as practice balls. The poodle is one of over 50 hygienic washable vinyl toys for babies. They are soft, pliable, and the colours are bright, fadeless and non-toxic. The majority of them are fitted with safety squeakers. They are individually packed in polythene bags with descriptive headers and prices range from 2s. 5d. to 12s. **Playcraft Toys Ltd., 120 Moorgate, London, E.C.2.**

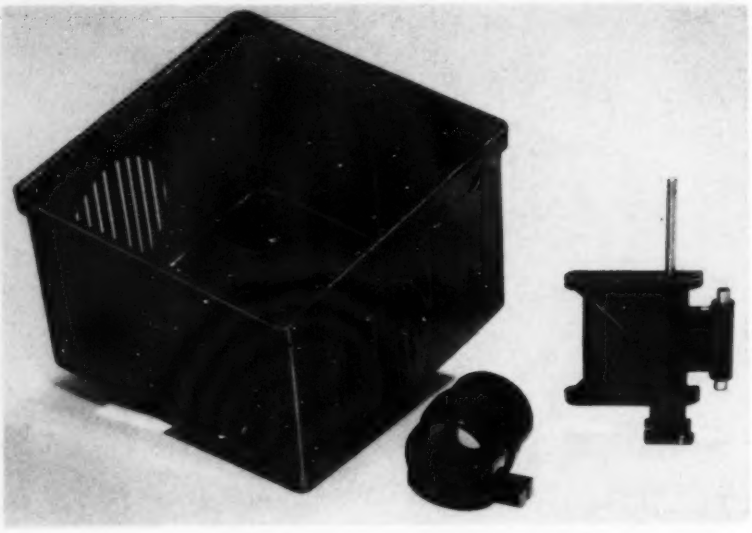


Aluminium-cored decorative laminates made by the company are being increasingly used in aircraft. Warerite is used for complete galley and for small tray surfaces; for tiny lavatory shelves and for dividing bulkheads, and for many other decorative or working surfaces. Warerite aluminium is dimensionally stable under exacting conditions and the thinner gauges can be readily bent and formed. Double sided Warerite aluminium fulfils the strictest specification of flatness and rigidity. Pictured is one of the bar units of a BOAC 'Britannia' with panelling in the Prima Vera wood pattern. **Bakelite Ltd. 12/18 Grosvenor Gardens, London, S.W.1.**

The company is one of the largest flooring concerns in the UK. The 28 colours in the Marleytile range give wide scope for design. Vinyl asbestos Marleyflex 1000 and 1200 can be laid over wood or concrete, is draughtproof and immune from rot and damp. The 1000 range is recommended by the firm for kitchens and canteens because of its resistance to oil and grease. Also produced are wall tiles, flexible skirting, stair nosing, MarleyFlor sheet floor covering, handrails and flexible surfacing materials. **The Marley Tile Co. Ltd., London Road, Riverhead, Sevenoaks, Kent.**

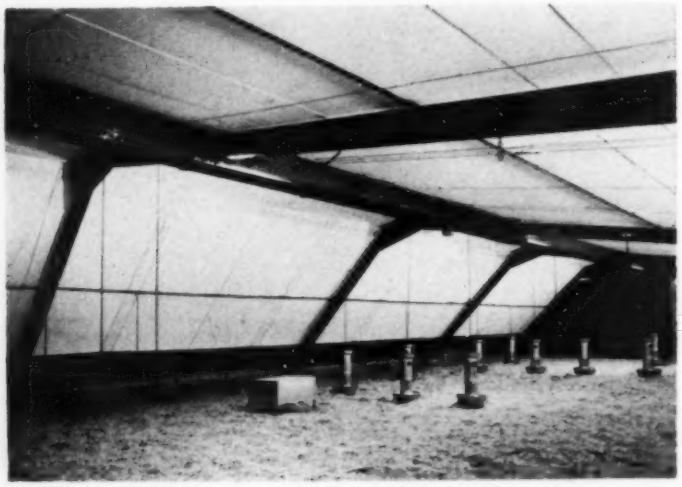


The company has recently installed plant for the dip lining and coating in PVC of work up to 5 tons in weight and 17 ft. x 7 ft. x 7 ft. in size (5,080 kg. and 5.2 m. x 2.1 m. x 2.1 m.), believed to be the largest plant of its type in Europe. Illustrated here is a 5-ft. (1.5-m.) flexible .030-in. (.76-mm.) wall seam-free PVC bellows collapsed to 1 ft. (.3 m.). This is made by the dip-moulding technique, enabling the production of complicated seam-free bellows at very low tooling costs. **Plastic Coatings Ltd., Woodbridge Industrial Estate, By-Pass, Guildford, Surrey.**



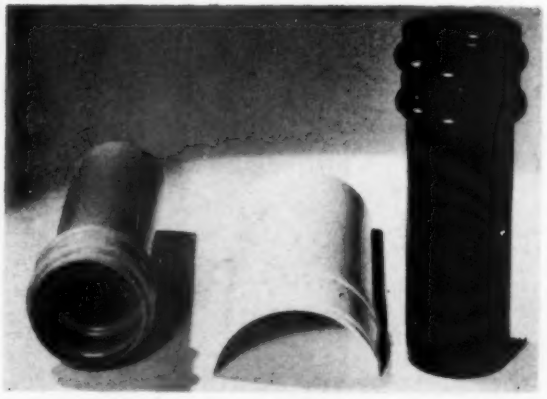
Believed to be the first industrial protective rubber boot manufactured with an external steel toe-cap, the BTR Steelex provides ' visible safety ' and thus gives the wearer complete confidence in his foot protection. The toe-cap is firmly bonded into the boot by a flexible steel wire mesh, which is welded directly to the toe-cap, giving the added advantage of armoured protection back beyond the toes. The toe-cap is designed to withstand a 150ft./lb. blow and conforms to BS 453, Grade 1. The boots are available with or without spring-steel midsoles. **BTR Industries Ltd., Footwear Division, Oxford Works, Derby Road, Burton-on-Trent.**

The company specializes in high-quality precision technical mouldings, for which it has an international reputation. The housing and internal components for the technican auto analyser, some of which are shown here, were supplied to the Technical Instruments Corpn., of New York. **Metropolitan Plastics Ltd., Faraday Way, St. Mary Cray, Orpington, Kent.**



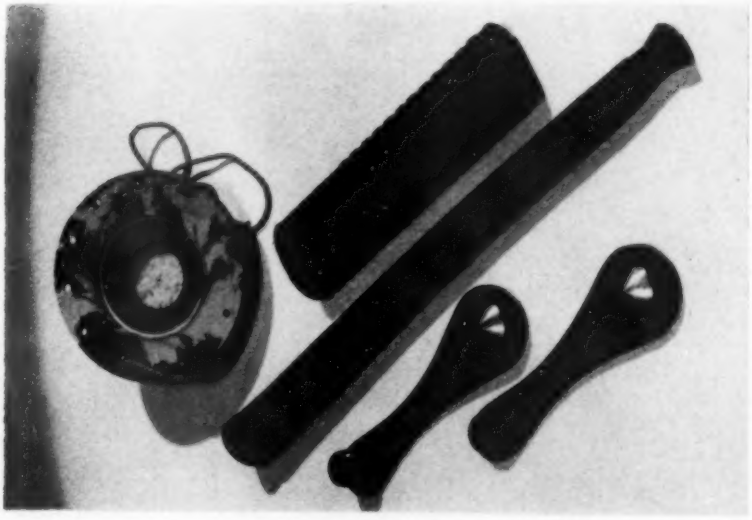
This broiler house is insulated with 1½-in. Polyzote boards 8ft. x 2ft., supported on taut wires and the joints between boards stuck with Bondastik. Polyzote is the trade name of the company's expanded polystyrene. Its K value is 0.24 B.Th.U.s. **Expanded Plastics Ltd., Mitcham Road, Croydon, Surrey.**

Vinyl rainwater goods are one of the company's more recent products. The range includes gutters, down pipes and fittings that need no painting and will never corrode. They will withstand the action of polluted air in industrial areas, as well as the normally destructive effect of sea air, acids, alkalis, salt solutions, petrol and oils. The periodic maintenance that is required with conventional cast-iron pipes is done away with. **The Marley Tile Co. Ltd., London Road, Riverhead, Sevenoaks, Kent.**



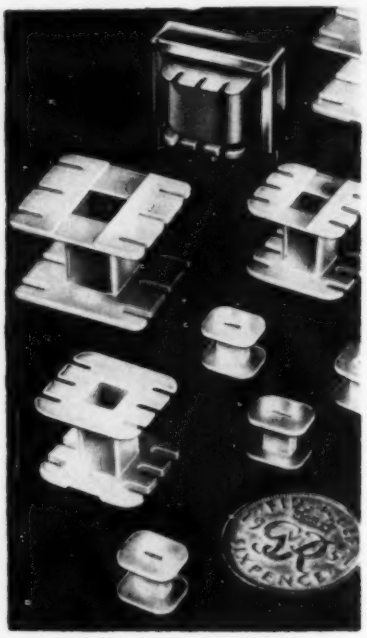
The company manufactures a wide range of synthetic resins and plastics materials, including Cellobond adhesives and binder resins, Epok surface coating resins and Rockite moulding materials and dough moulding compounds. It is sole selling agent for Rigidex polythene manufactured by British Hydrocarbon Chemicals, and Styron polystyrene produced by Distrene Ltd. The rope that the trawlerman is handling is made from Rigidex high density polythene; it is light, resistant to fraying and does not absorb moisture. **British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1.**

Demands for Vyon, the microporous material introduced by Pritchett and Gold and EPS Co. Ltd. last year, have been so great from home and overseas sources that a new company—Porous Plastics Ltd.—was formed earlier this year to handle the manufacture and marketing of it. Vyon, which is made from Ziegler high-density polythene, has proved successful in many fields, including air and liquid filtration, air-fluidized powder conveying, electrolyte diaphragms, orthopaedic splints and appliances, powder aeration pads for silos and bunters, de-ionizing equipment and for filters and silencers on pneumatic equipment. Illustrated is a small filter incorporating Vyon filter candle. **Porous Plastics Ltd., Dagenham Dock, Essex.**



As manufacturers of sports equipment, the company have established over the years, both at home and overseas, a high reputation for their varied range of products. In addition to the popular Golf Pride rib lock grip, with its cork and rubber construction of unique design, Avon also produce for golfers Whitcombe wind-on grips, golf ball cleaners, lifters and tees. Other export items include table tennis sheeting, punchball strands, spiked batting glove rubber, tubular grips for cricket bats and hockey sticks. **Avon India Rubber Co. Ltd., Sports Department, Melksham, Wiltshire.**

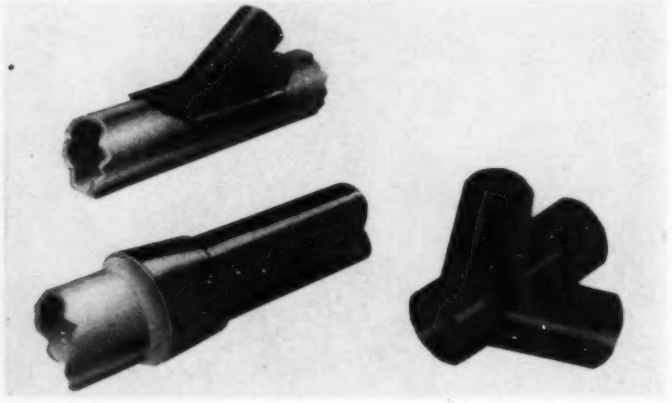
The elephant, the duck and the cat are three cheerful characters from the company's range of vinyl squeaky toys. They are 4¼in. high—the goofy dog is an example of a larger toy. These squeeze 'n' squeak animals are made in yellow and pink and are hand decorated in non-toxic colours. Their expressions range from shocked indignation to amiable vacuity. **William Oliver's (Rubber) Ltd., 132a Blackhorse Lane, London, E.17.**



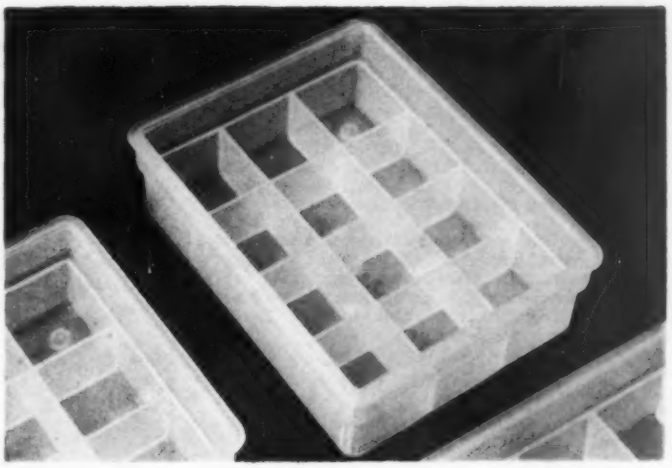
The company have for many years been specialists in contract moulding nylon coil bobbins by their GG MiniMoulding process. A stock range has now been introduced to meet the fast-growing demand of the radio and electronics industry for miniature transformers for printed circuit and similar work. Initial sizes are for square stacks of MEA 187 (RCL 450), MEA 262 (RCL 531) and MEA 218 laminations. The bobbins are designed with universal slots for bringing out leads and a hole flush with the inside of former for the first tap. Nylon bobbins, being a one-piece construction, cut winding and handling costs and have excellent dielectric strength. As they are produced by a high-speed single-impression method, accuracy and uniform quality are obtained at low cost. **George Goodman Ltd., Robin Hood Lane, Birmingham 28.**

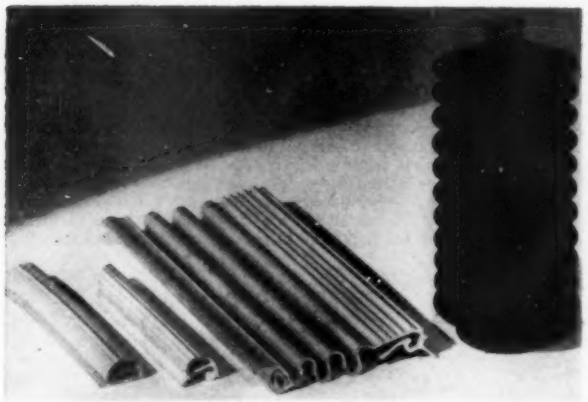
This company has been manufacturing adhesives for half a century. Starting with the supply of natural rubber solutions intended mainly for the car and footwear industries, it has continually extended its range so as to take advantage of new materials in widening the field of application of adhesives. The firm's adhesives are used in many products, from cars and aircraft to toys and light engineering items. **Surridges Patents Ltd., Elmers End, Beckenham, Kent.**

Pictured are three new pipe fittings introduced a few months ago by this company, who produce pitch fibre pipes in diameters from 2 to 6in., as well as electrical conduit and perforated pipe for land drainage and sewage disposal. UAM Plastics Ltd., another member of the group, produces Unilux translucent glass-fibre reinforced plastics sheeting in various colours and in a variety of profiles to suit all the standard corrugations used for roofing and cladding. The sheeting is also produced in a fire-resisting grade, and in the form of double-skinned insulating lights. Flat sheets are also available for decorative and other uses. **Union Fibre Pipes (GB) Ltd., Tolpits, Watford, Herts.**



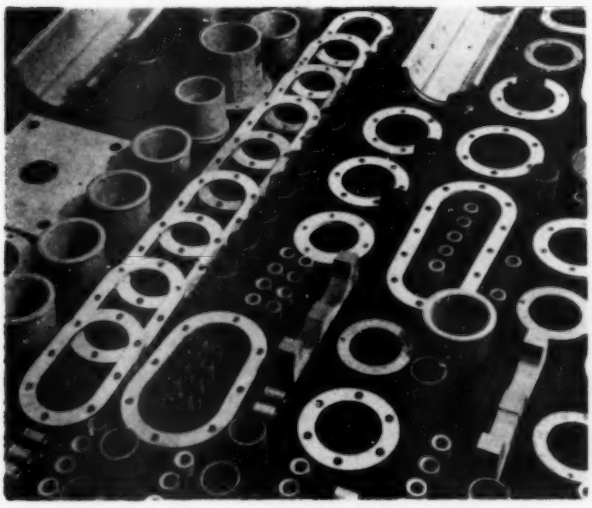
When present plans are completed at Shell's plant at Carrington, Manchester—which should be next year—the polyolefin capacity will be 30,000 tons. This figure is composed of polythene and polypropylene. Already Shell Chemical supply a very large number of manufacturers with plastics raw materials, and a wide range of products is being manufactured from Carlona polythene and Carlona polypropylene. Illustrated are moulds in which packet jelly cubes are prepared, manufactured in the company's polypropylene. They are made by Pioneer Plastics, of Feltham, Middlesex, who chose the material because of its ability to withstand pressurized steam sterilization. An important announcement during the year was that Shell International are to set up a new company which will produce polyolefin film outside USA and Canada, with its headquarters in London. **Shell Chemical Co. Ltd., 170 Piccadilly, London, W.1.**





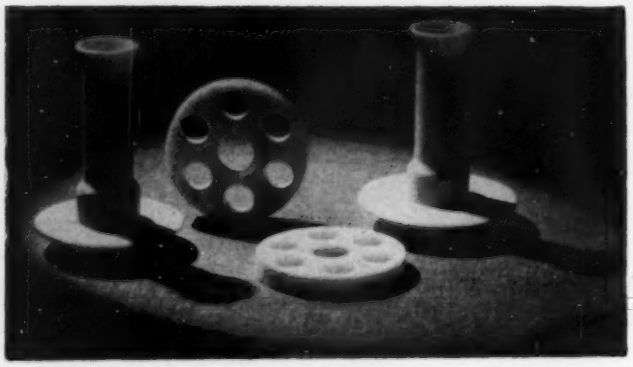
The company is very well known for wheels for industrial and domestic use, and has built up a high reputation for the manufacture of mouldings in sponge and solid rubber, extrusions and mechanical goods to specification. The company also has a large plastics factory specialising in the moulding, extrusion and fabrication of components for the refrigerator, car and other industries. **Capon Heaton & Co. Ltd., Hazelwell Mills, Stirchley, Birmingham 30.**

Feltite $\frac{3}{16}$-in. id draught excluder tubing is made up in 60-ft. and 16-ft. coils, the latter being sufficient for one door frame, and is available in brown, green, cream and mushroom. Each coil is individually wrapped in Cellophane. 32-in. (81.2-cm.) long draught excluder strips are manufactured in a standard length, which can easily be cut to fit any interior house door. They are available in the same four colours as the tubing. They are used for excluding draughts from along the bottom of doors and will seal any gap up to $\frac{1}{4}$in. A new line marketed this autumn is a $\frac{3}{16}$-in. id all-plastic draught excluder tubing in 60-ft. coils in tan, green, white, mushroom and transparent. **Ardray Manufacturing Co. Ltd., 96/100 Aldersgate Street, London, E.C.1.**



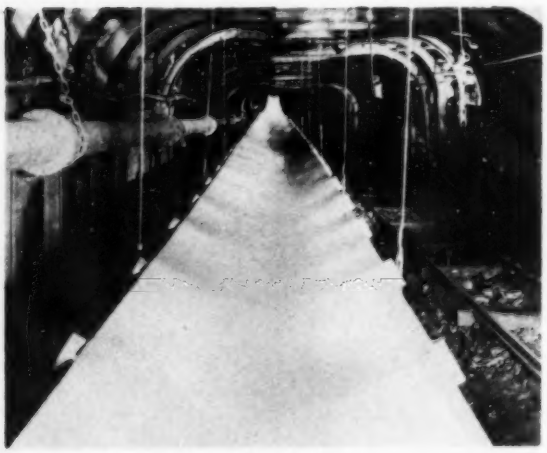
The wide range of industrial laminated plastics with asbestos-based reinforcement, manufactured by the company, is being used for an increasing number of applications both at home and overseas. The several grades comprising the full range provide suitable physical qualities for widely varying journal pressures, speeds, temperatures and desired coefficients of friction. Typical applications showing marked success include rolling mill bearings, stern tube bearings, agricultural and road-making machinery bearings and wear strips, locomotive and railway carriage bogie pivot liners and wear sleeves, paper-making machinery and vibrating screens. In addition to the normal grades, those impregnated with graphite are assisting designers to resolve problems where lubrication is neglected or limited. **J. W. Roberts Ltd., Chorley New Road, Horwich, Bolton.**

The company manufactures Freeflex semi-rigid and flexible containers from both polythene and high-density polythene. The sizes step up from 2 oz. to 2 gal. (70 c.c. to 9 litres). Illustrated are the 1-gal. wide-neck, high-density polythene container with attached handle, and the 2-gal. size. Between them is the 90-oz. standard neck polythene container. A number of baby products are manufactured, including the Suba Seal Staywarm complete baby feeding unit pictured. This consists of an outer container of expanded polystyrene, an 8-oz. boilable feeding bottle with a rubber teat and a polythene bottle cover and measure. The baby's feed, prepared, bottled and placed in the Staywarm unit at maximum mixing temperature, will reach feeding temperature approximately four hours later. **William Freeman and Co. Ltd., Subaseal Works, Barnsley, Yorkshire.**

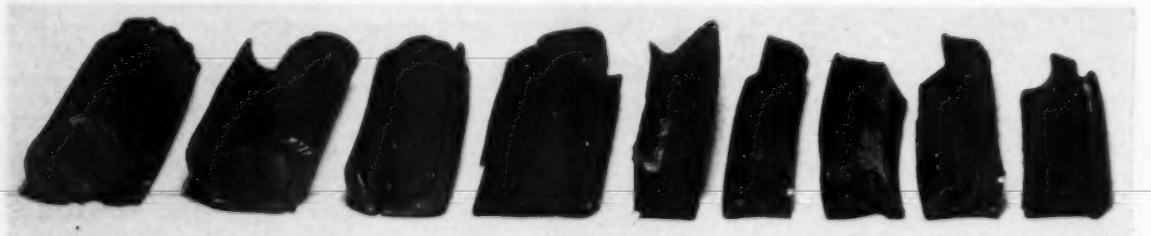


Permaflon baffles and insulators are shown: Permaflon is the company's trade mark for processed polytetrafluoroethylene. This has high temperature resistance, chemical inertness and a low coefficient of friction. It is used for machined parts, moulded or coined forms and dispersion coatings. Among the company's other products are wood laminates for flooring, engineering purposes and electrical insulation. Glass-fibre reinforced plastics materials are also produced. Permacast, the company's epoxide resin, is used in castings, mouldings and for encapsulation. **Permali Ltd., 125 Bristol Road, Gloucester.**

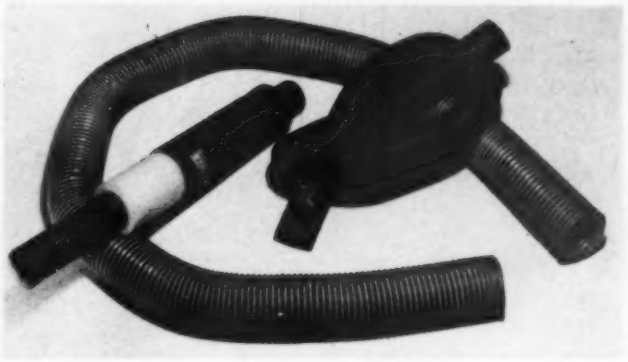
This 42-in. (107-cm.) four-ply Mitcham Plyastic PVC belt incorporating cotton/nylon duck, is working on a large trunk conveyor system in a North Country mine. This belt has been awarded National Coal Board approval and is giving service in a number of important trunk projects. The duck used is of a special construction designed by the company to give twice the strength of 32-oz. (908-g.) standard cotton duck. This construction provides a belt having greatly increased flexibility. The nylon weft is also said to give improved impact resistance, joint-holding efficiency and greater tear strength. This new duck is used in a number of the specialized belts made by the company and has been running under many varied conditions, not only in this country, but also overseas, and is giving excellent service. **Barrow Hepburn and Gale Ltd., Church Road, Mitcham, Surrey.**

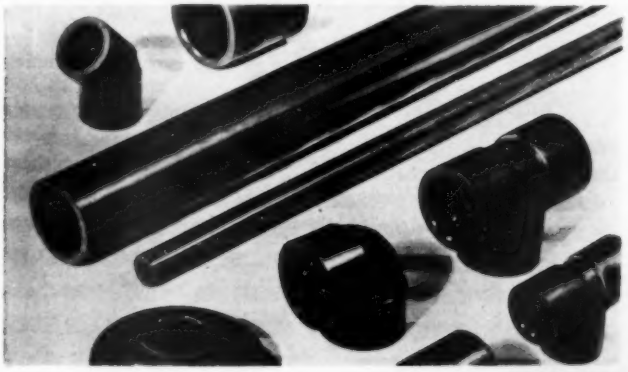


A number of profiles extruded by the company are shown. A large range of big and small mouldings and extrusions is produced for the car and allied industries. Rubber Bonders Ltd., an associated company, produces a variety of rubber-to-metal units to specification, in addition to a standard range of mountings and couplings. **Empire Rubber Co. Ltd., Dunstable, Beds.**

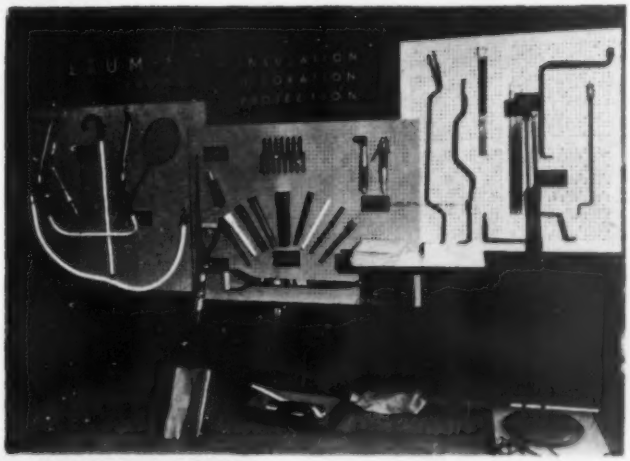


Spiratube, Flexflyte, Thermaflex and Flexvent are the trade marks of a range of lightweight, high-performance flexible ducts, developed in USA and manufactured in the UK under licence. Although varying widely in diameter ranges and resistance to high and low temperatures, acids, alkalines and solvent fumes, they all have characteristics of extreme lightness, toughness, flexibility and high performance. Spiratube—the big-bore hose, available from 3 to 30in. id—may be seen running for thousands of feet through hydro-electric tunnels and mines for general ventilation. Very few UK and US aircraft are flying which do not carry considerable quantities of Flexflyte for cabin conditioning, instrument cooling, cargo space heating, and so on. Thermaflex is widely used in the air-conditioning industry, particularly as flexible connections between diffusers and main trunk lines, whilst most of the domestic tumbler dryers on sale in the UK and USA are equipped with a length of Flexvent for ducting away moist lint-laden air. Fundamentally, these products are constructed of fabrics with various rubber and plastic coatings, supported by a steel wire helix. **Flexible Ducting Ltd., Shura Street, Glasgow, N.W.**

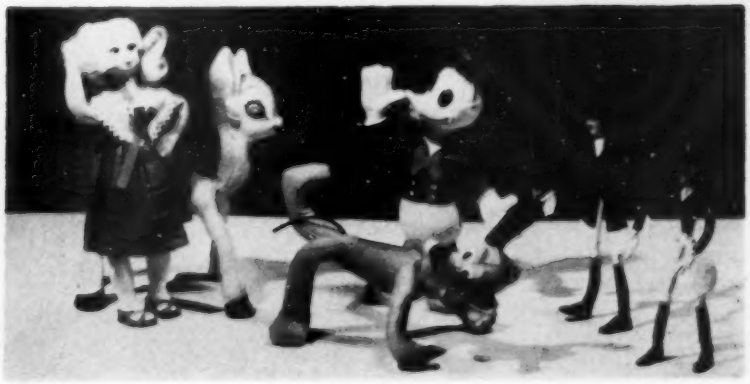




Manufactured from unplasticized PVC and available in normal and high-impact qualities, Silverflow pipes and fittings combine inherent qualities of corrosion resistance, ease of installation, low weight and resilience, and resistance to shock loading. They have an extremely wide industrial application—for example, in building, chemical, petroleum, plating, metal, textile and atomic energy fields. They can be joined by flanging, heat welding, solvent welding or threading (BS 21 taper thread). Threaded Silverflow pipe fittings are designed with the threads recessed to prevent damage during shipment—a design which provides a protective collar to unused threads and prevents cross-threading. **ETR Industries Ltd., Hose, Linings and Coverings Division, Herga House, Vincent Square, London, S.W.1.**



A variety of applications of Vietum shrink sleeving are illustrated. This PVC sleeving is extruded by the company and used by manufacturers of many products from pushbars for prams to busbars for electrical insulation. It is easy to apply and insulates, decorates and protects. The company has a high reputation as a moulder. Its finishing processes division produces a range of materials basically designed for the finishing of metal and plastics parts. **Lacrinoid Products Ltd., Gidea Park, Essex.**



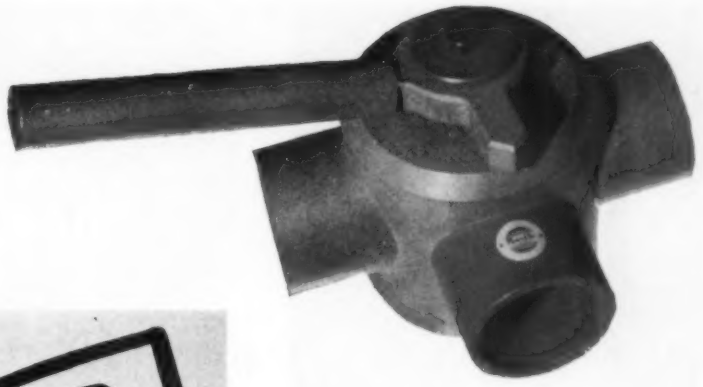
Bendy toys have the great advantage of not being ' passive '. Wire moulded into foam rubber enables a child to bend the toy into any number of positions: from one toy he can create an infinite number of toys. Here Donald Duck and Pluto show what they think of Mary and her little lamb, while the two riding figures look on. **Newfeld Ltd., Newfoam Works, Spelthorne Lane, Ashford, Middlesex.**

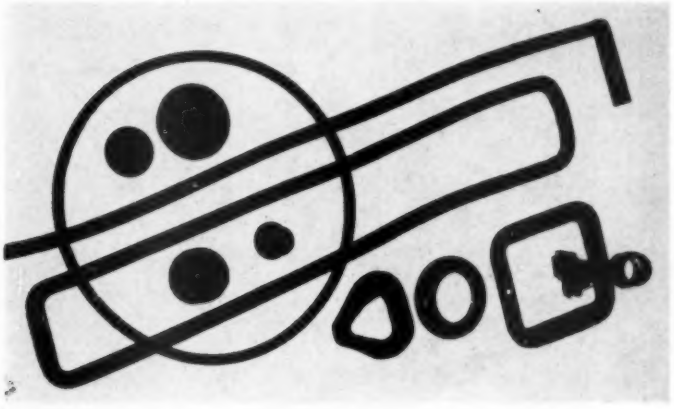
Redfern's rubber soles and heels are used by many shoe manufacturers and repairers. A lightweight stick-on sole—called the Hi-Fashion—is produced especially to meet the growing demand for fashion shoes. It is made from an entirely new formulation, is wafer thin and has excellent wear resistance. Market research has shown the value of advertising mats, which put the message at the feet and fingers of the consumer. A foot mat is illustrated. **Hunter Hardy Ltd., Dawson Street, Hyde, Cheshire.**

As in other trades, continental designs have entered into the shoe trade. Sussex Rubber's Rivoli units show a continental influence and are made in black, brown and in a special translucent mix. Varsity units have an asymmetrical pattern and although only recently introduced, have proved enormously popular. Wafolite featherweight stick-on soles are produced in a special resilient gristle rubber for long wear. Another popular line from Sussex is Hypatex tiles. Great resilience and outstanding recovery after indentation are claimed for them, as well as resistance to scratching, staining by food or beverages. They are particularly suitable for marine work because they have exceptional resistance to atmospheric ozone; will not fade in direct sunlight; and do not buckle or crack under moisture and temperature fluctuations. **Sussex Rubber Co. Ltd., School Road, London, N.W.10.**

The moulded hot water bottles illustrated are now made exclusively for export. Hytex say that overseas demand for moulded bottles is such that all production for the next eight months will be exported. Other surgical items exported are the moulded ice bags and fountain syringes shown. The picture is completed by the inclusion of some moulded rubber components being supplied to overseas manufacturers for use in their own products. **Hytex Ltd., 304 Latimer Road, London, W.10.**

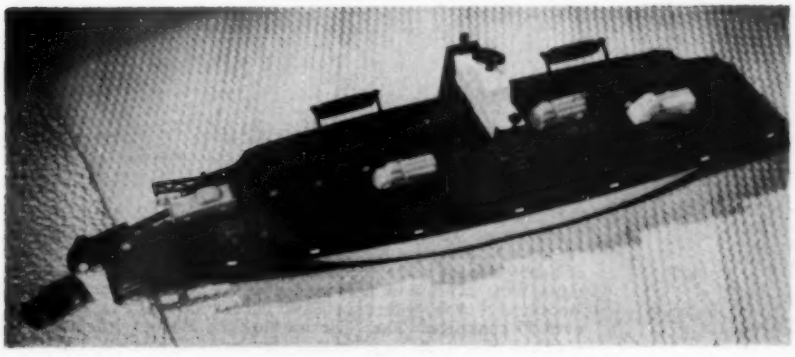
The company's three-way valves were initially produced for use by a Government department. They have now been added to the range of Barflo all-plastic valves. They are made of Kralastic styrene/butadiene acrylonitrile copolymer, British Geon's high-impact PVC or other suitable plastics materials. **Barflo Ltd., 56 Cavendish Place, Eastbourne.**



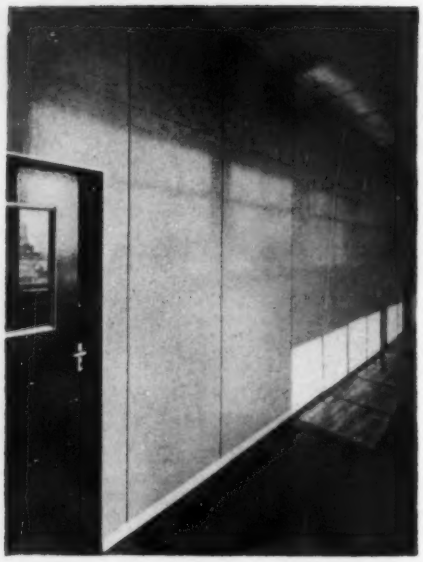


In addition to its established production of open and closed cell sponge in both natural and synthetic rubbers, this company continues to expand its production of solid mouldings and extrusions, a number of which are shown. A special department has been opened for the manufacture of extruded and formed windscreen rubbers. The products of closed cell sponge to Ministry specification for packing has also been greatly extended. The production of Sorboprene (foamed polyether) has been doubled to produce cushions for cars, aircraft, British Railways and the upholstery trade. **Sorbo Ltd., Woking, Surrey.**

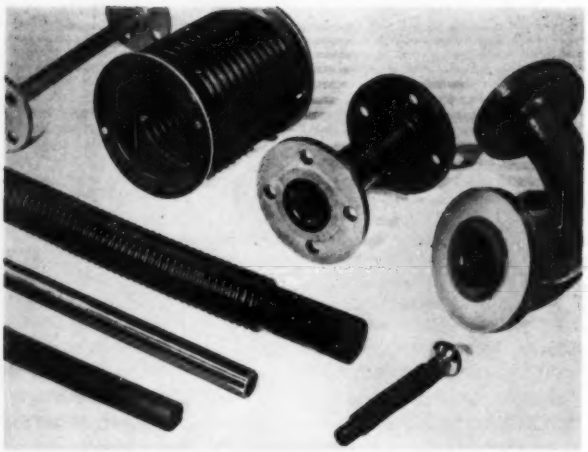
One of the division's more recent products is Vynolay vinyl floor covering. This cannot rot and is resistant to chipping and cracking. It is deep patterned—the pattern goes right down to the backing—and there is a full range of 12 colours. It is simple to lay, comes in rolls 48in. wide and retails at 13s. 6d. a sq. yd. **Dunlop Rubber Co. Ltd., Dunlopillo Division, Rochdale, Lancs.**



This Mettoy ferry boat is one of the more complicated polythene toys produced by the company. Its construction makes it suitable for both the younger and the older child; it can be completely taken to pieces and re-assembled and may be pulled along by rollers fitted under the hull. It has a full complement of brightly coloured vehicles, there is a radar screen, searchlights and four lifeboats. It retails at 19s. 6d. **Mettoy.**



'Holoplast' laminated plastics structural panels, which can be filled with insulation materials are used for office partitions and for exterior use in curtain walling. For exterior use the panel can be supplied in two integral colours of natural brown and terra-cotta, or with the 'Decorplast' surface, which can also be applied for interio ruse. A special range of 'Decorplast' colours and patterns is available for this purpose; Decorplast decorative laminated plastics sheet is resistant to most common materials, hygienic, easy to clean and the colours are light-fast. **Holoplast Ltd., New Hythe, nr. Maidstone, Kent.**



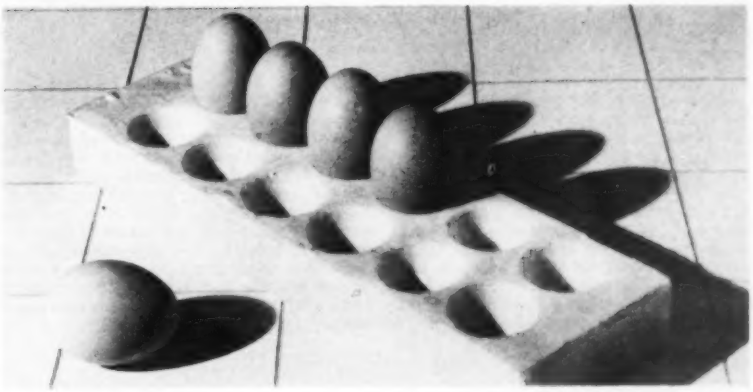
The special characteristics of PTFE in its resistance to wide ranges of temperatures and its inertness to most known chemicals make it particularly suitable for the fabrication of pipes and pipe fittings for aircraft applications—and increasingly in other industries. The company has developed an extensive range of such products—including PTFE-lined stainless steel pipes—under the trade name Fluoroflex. A typical example of their application is the use of Fluoroflex high-pressure pipes in the DH Comet 4B aircraft. **BTR Industries Ltd., Aero Products Division and Hose, Linings and Coverings Division, Herga House, Vincent Square, London, S.W.1.**

A new addition to the company's range is this Enchanting Rose make-up cape and cap set. It is in nylon, specially embroidered for the company with rose motifs and backed with opaque plastic. The set is packed in a gold presentation box, and each dozen is supplied on a gold counter display rack. The retail price of the cap in the UK is 9s. 11d.; that of the make-up cape 29s. 6d. **I. B. Kleinert Rubber Co., 91 New Bond Street, London, W.1.**

Non-burn surface hot-water bottles, single and double sided, feature prominently in the company's range, which includes over 50 different designs. Illustrated are the Velvetex and the cat, one of the Noah's ark series of full-size bottles in animal shapes. Rubber trays, table mats, dust pans and over 20 different types of mats are included in the wide range of products which this firm exports to over 50 countries. **The Cannon Rubber Manufacturers Ltd., Cannon Works, Ashley Road, Tottenham, London, N.17.**

The total exports of Cressite moulded and extruded components, of which a few are illustrated, continues to expand. Pet accessories are shipped in increasing volume overseas, particularly to USA and Canada. Apart from direct exports, a large proportion of production is sold overseas as component parts of other UK manufactures. **Cressall Tyre and Rubber Co. Ltd., Cressite Works, Oyster Lane, Byfleet, Surrey.**

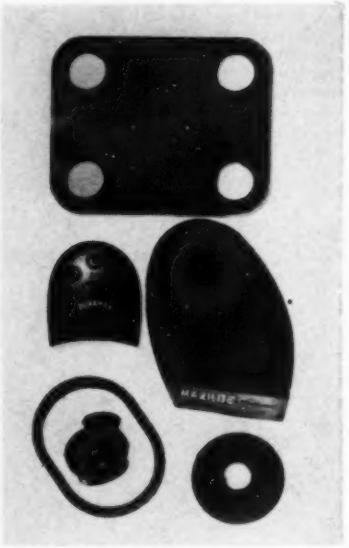
Flexible foams are manufactured by the company in solid or profiled forms for the upholstery and other trades. Pipe lagging, foam weatherstrip and arm pads are among other products; illustrated is a refrigerator egg tray nest moulded in polyurethane. **Lintafoam Ltd., P.O. Box 25, High Wycombe, Bucks.**



This year the company introduced Plastolene, which is the result of an exclusive process of laminating specially constructed Terylene fabrics between two layers of flexible PVC sheeting. One large market for this product will be the protective clothing industry: an example is this smock and trousers by the Quadrant Sailing Co. Other possibilities are sports ground covers, awnings, garden furniture and swimming pool liners. By using different formulations of PVC and different types of Terylene, Plastolene can be produced with physical properties to suit many requirements. **Storey Bros. and Co. Ltd., White Cross, Lancaster.**

Skin Thin, the company's new lightweight latex glove, has been designed for delicate jobs requiring a light-fingered touch. They are manufactured in two colours. Suregrip gloves continue to be a fast-selling line. They are made of durable high-quality latex in a shade of primrose yellow and are Sylkette lined. Both these lines retail at 4s. 6d. a pair. The Red Indian toy shape pictured is one of Ariel Balloons' most popular novelties. Another development from Ariel is the chain balloon: provided with a loop at the end so that a number of balloons can be linked end to end. **London Rubber Co. Ltd., Hall Lane, Chingford, E.4.**

The company fabricates a variety of plastics materials. The illustration shows a section from their wide range. Letters are produced in all colours from ½in. to 12in., routed or jigsaw in block and script styles, with plain or bevelled edges. Also produced are built-up fascia letters in plain block or to specification; PVC self-adhesive letters for sales display on car windscreens and so on; display stands in Perspex and PVC rod; storage display containers in timber and clear Perspex; machine guards and accessories; displays and containers for the food trade, including self-service partitions and refrigerator linings and show cards for all trades. The company specialises in silk screen printing and Embossing on plastics. **Olympic Plastics Ltd., Fourth Way, exhibition Grounds, Wembley Park, Middx.**

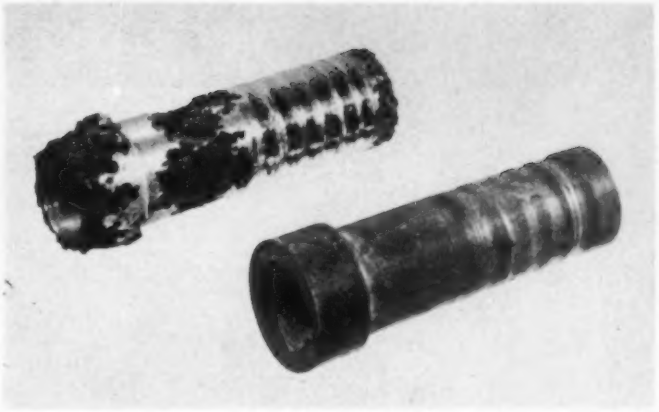


This company specialises in rubber products for the boot and shoe trade as well as moulded mechanical rubbers for widely diverse industries throughout the world. The illustration shows a Duramax concave heel, a Maxilite resin rubber half-sole, a sealing gasket, a suspension washer, a gear lever gaiter and an engine support rubber. A full range of rubber soles, heels, stick-on-soles, sheets of soling and top-piecing material are available in different designs in black and brown, also Maxilite resin rubber light-weight half-soles, soling sheets and stick-on-soles. Mechanical rubbers are supplied to manufacturers in the radio, television, refrigerator, motor, bottling and preserved food trades. **Duramex Ltd., Marlborough Works, Marlborough Road, London, N.19.**

An eye-catching and hard-wearing range of inflatables is marketed by this company. The inflatables gained popularity on their introduction at the Brighton toy fair earlier this year and they are now being exported to a number of countries. Many of the items are equally suitable for the beach, garden or indoors and the range caters for all age groups. It includes air beds, cushions, swim-rings, rafts, beach balls, paddling pools and dinghies. Made from PVC, the inflatables are packed in polythene. An associated company, ITS Rubber Ltd.—both are members of the Charles Colston group—produces a range of 'Commando' soles and heels for industrial and domestic markets. This year two sergeants did a record-breaking walk on 'Commando' soles and heels—3,000 miles from coast to coast across America. **Minibrix Ltd., 7-11 Lexington Street, London, W.1.**

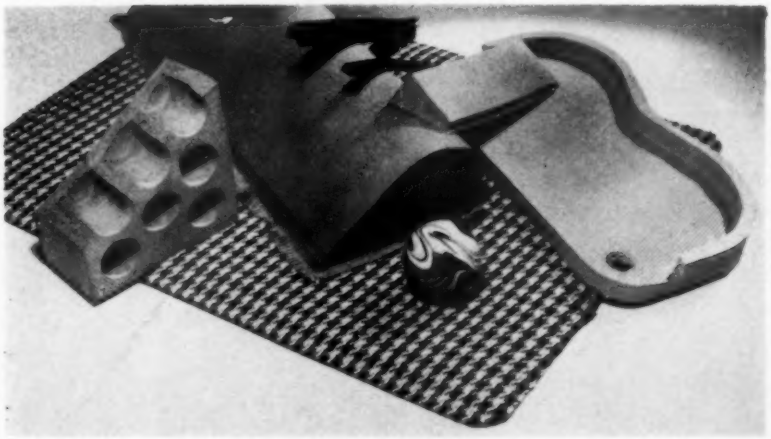
The comprehensive and attractive range of PVC handlegrips manufactured is especially suitable for application requiring durability, bright colouring, cleanliness and point of sales appeal. This company, pioneers of PVC grips in the UK, presents a selection of patterns to suit ⅜in., ½in., ⅝in. and 1in. bore tubing in red, blue, green, grey, white, primrose and tan. A similar range is also manufactured in rubber. Dipped PVC items are widely used in connexion with awkward ' covering ' applications when low initial tool costs and infrequent replacement rates are wanted. The mechanical rubber department caters for a large variety of mouldings, notably for the automobile, cycle, motor cycle and domestic trades. Extruded sections to special requirements are also featured. **Precision Rubber Products (Denton) Ltd., Heaton Works, Denton, Manchester, Lancs.**

The 'Vit-Air' dust respirator has been designed for the Home Office to give protection against dusts which cause pulmonary diseases such as silicosis and asbestosis. Shown here also is the Vit-Air respirator which is suitable for protecting men who have to enter enclosed spaces where the atmosphere is known to be or may be toxic. The breathing tube is made in standards of lengths and two lengths can be connected together without making it too difficult to breathe. **J. E. Baxter & Co. Ltd., Respirator Assembly Factory, Leyland, Lancs.**

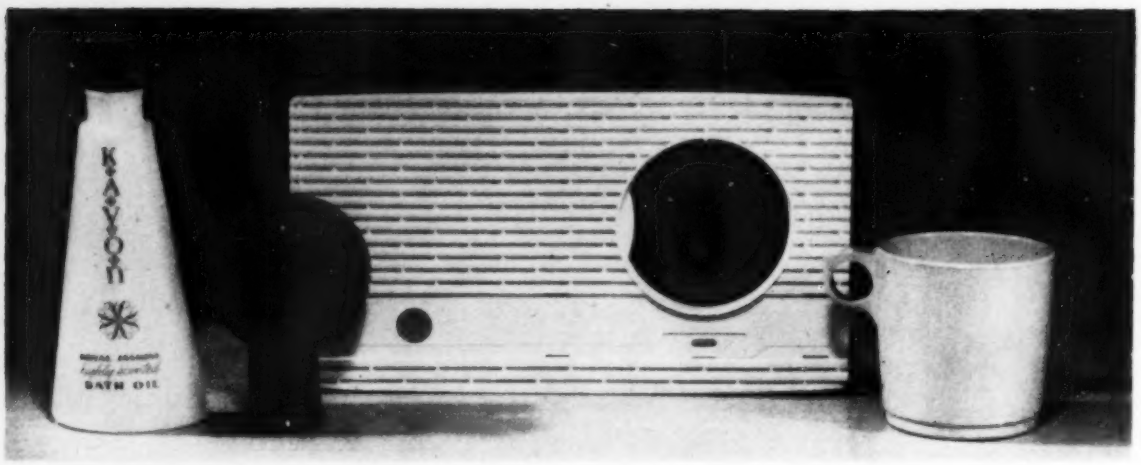


A laminated plastics material of unlimited versatility, Tufnol is used throughout the world for components such as gear wheels, ships' rudder and stern tube bearings, aircraft and motor parts, jigs and formers. It is made in numerous brands in sheet, tube, rod, angle and channel that comply with British and other national standards. The Tufnol (*on right*) and steel sleeves shown here have each given nine months' service rotating at 1,465 rpm keyed to the shaft of a tidal river water pump. The next pair of Tufnol sleeves fitted were run for over 12 months without having to strip the pump for examination. No tightening on the packing gland was necessary, but this had to be done every week with the stainless steel sleeve. **Tufnol Ltd., Wellhead Lane, Perry Barr, Birmingham, 22b.**

The company's products include low density blown sponge mouldings of all kinds for the motor and furniture industries, etc. First-class dipped products include 'Metballoons up to 100g., oxygen and air bags, and a variety of specialities. A valuable feature of the company's blown sponge moulding process is the low cost of short runs, and the fact that more complex designs are possible than with latex of plastics foam materials. **Lea Bridge Rubber Works Ltd., Lea Bridge, London, E.5.**



Among other major activities, including the preparation of 'custom' or 'bespoke' PVC and rubber compounds, backed by technical service, the company manufactures a wide range of industrial PVC sheeting and tape and the well-known Phenco flooring in sheet and tile form. **Phoenix Rubber Co. Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks.**

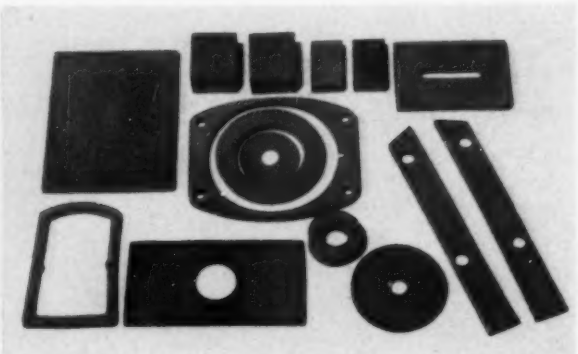


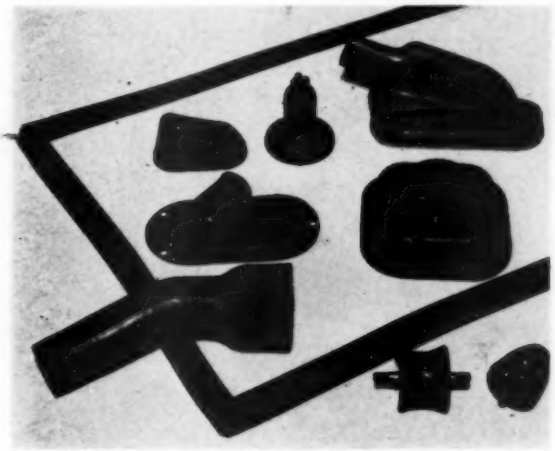
The wide range of work undertaken by the company includes blow moulding, of which the 'Kavon' bottle is an example and the manufacture of shrink sleeving for a multitude of uses. Work in thermoplastics is typified by the phenolic sprayer nozzle, for the Plessey Company; the radio cabinet front in the company's own urea formaldehyde, for Murphy Radio; and the melamine canteen mug. **Lacrinoid Products Ltd., Gidea Park, Essex.**

Samples of the company's X-ray protective rubbers are submitted at regular intervals to the National Physical Laboratory for test. Each article bears a mark indicating its lead equivalent. The X-ray protective gauntlets shown here, with their curved fingers, have been designed especially for the manipulation of controls. **J. G. Franklin and Sons Ltd., Birkbeck Works, Colvestone Crescent, Dalston, London, E.8.**

The company's Geon PVC has been used by Bernard Wardle (Everflex) Ltd. for the leathercloth exterior finish of this Decca transistor portable radio shown at the 1960 Radio Show. The durable handle of the radio is also in Everflex. Geon PVC is manufactured by **British Geon Ltd., Devonshire House, Piccadilly, London, W.1.**

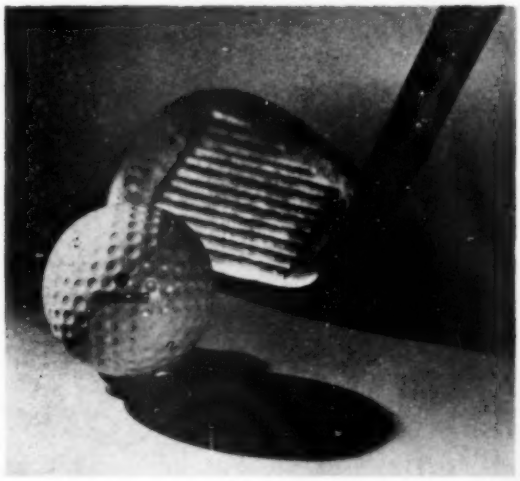
The articles shown are made from Starlite non-intercellular sheeting. This material has little or no absorption and is ideal for industrial or specification packing. Starlite is used in the shoe trade as a filler and in the car industry for lamp gaskets, washers and anti-vibration pads. The company specialize also in all sponge mouldings and sheetings and make the well-known Airtred sponge-backed rubber flooring. **The St. Albans Rubber Co. Ltd., The Camp, St. Albans, Herts.**



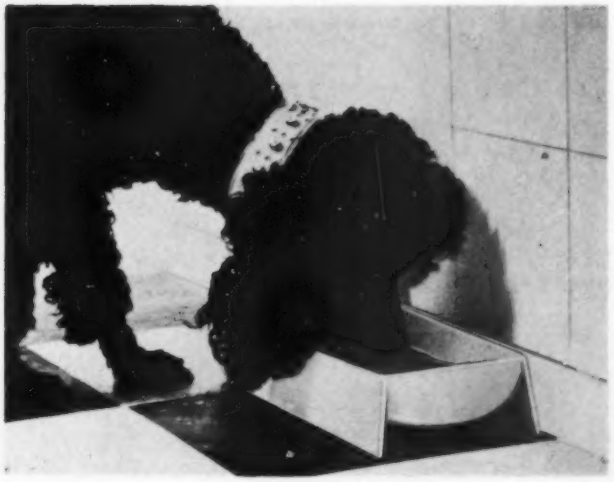


For many years closely associated with the motor industry, the company is extensively engaged in the manufacture of extruded and moulded items as windscreen trim, backlights, quarterlights, sponge trunk lid and door seals. A recent development is a self-conforming grommet which is finding increasing use in the electrical industry. Rubber Bonders Ltd., an associate company, bonds rubber to metal in standard ranges and to specification. **Empire Rubber Co. Ltd., Dunstable, Beds.**

The Aeroplas Division of this group of companies produces blow-moulded articles from equipment designed by their Australian associates, L. and I. Glenn Pty. of Melbourne. Recently introduced is a range of blown polythene toys, some of which are shown here. Also being marketed are blown polythene containers from 1 to 5 gallons capacity (4.5-22.75 litres) in a variety of shapes. **Plysu Products Ltd., Woburn Sands, Bletchley, Bucks.**

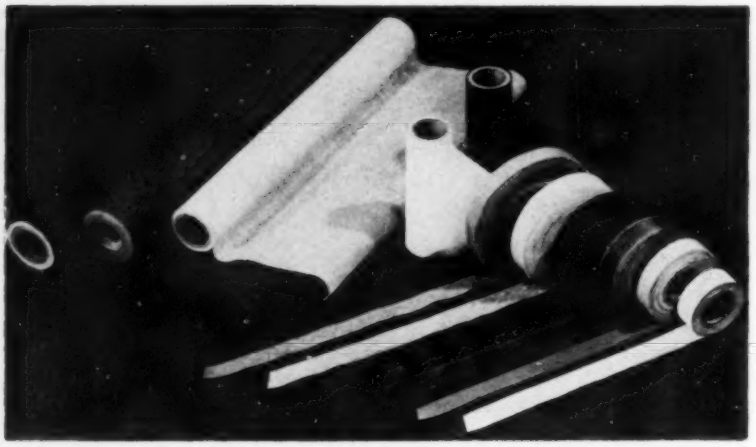


Reintroduced earlier this year, the famous ' Silver King ' golf ball met with instant success. Silver King balls were used by the winners of this year's British and French Open Championships. Each individually numbered ball is wrapped in polythene film. **A. G. Spalding and Bros. Ltd., Putney Wharf, London, S.W.15.**



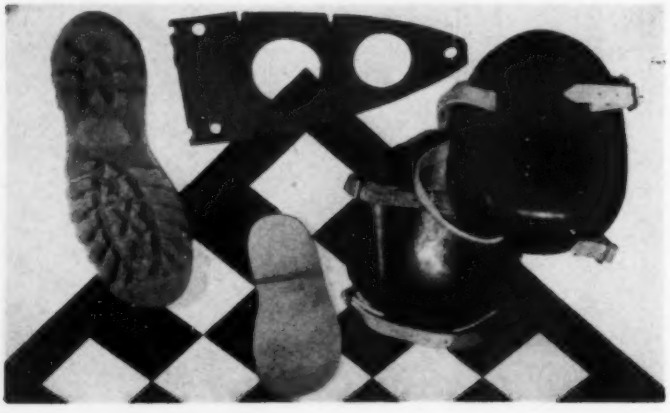
The moulded articles manufactured by the company cover so comprehensive a range that only a few can be mentioned. They include refrigerator liners, radio and TV cabinets, baths, mixing bowls, hotplates and lavatory seats. Illustrated is a ' Gold Seal ' dog trough of non-tip design available in several colours. **Ecko Plastics Ltd. Southend, Essex.**

Insulating cloth and tapes for the great majority of the needs of the electrical industry are manufactured by the company, using numerous base materials coated with specially developed resins. A range of flexible insulants, trade name Linapex, covers all Class A requirements of the appropriate British Standard. A further insulant, Linapol, has a glass fabric base coated with polyurethane resins and suitable for Class F service. For exceptional heat resistance over prolonged periods, Siloplast, a silicone-coated glass fabric, has been developed. **Ioco Ltd., Anniesland, Glasgow, W.3.**

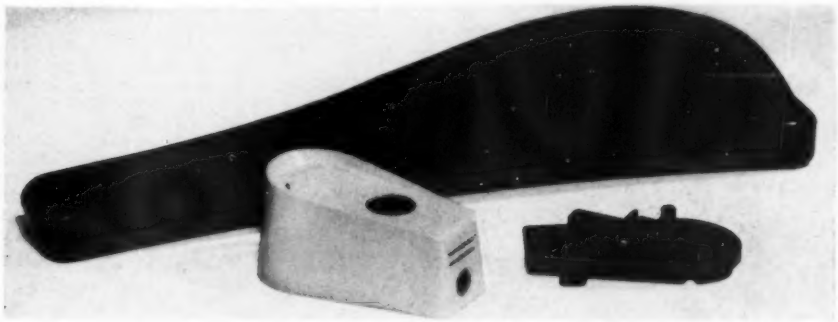


Plastolam and Plastovac, the company's vacuum-forming grade of PVC, are used in the Revelation suitcase shown here on the left. Plastoglass, a PVC film reinforced with woven glass fibre by a special laminating process, is used for the Antler 'Airlight' luggage on the right. Astonishingly strong, Plastoglass has an overall weight of 23½oz./sq. yd. and a bursting strength of 212lb./sq. in. The company has a worldwide name as well for its great range of printed PVC film. **Storey Bros. Ltd., White Cross, Lancaster.**

Recent additions to the company's well-known 'Blue Riband' range include a polythene bath, 25in. x 17¼in. x 9¼in., laundry basket, cutlery tray and a 2-gallon water carrier, illustrated here. The range includes also bowls, buckets, bread bins and many injection moulded components to order. The company is one of the P. B. Cow group. **London Moulders (Plastics) Ltd., 364-366 Buckingham Avenue, Trading Estate, Slough, Bucks.**

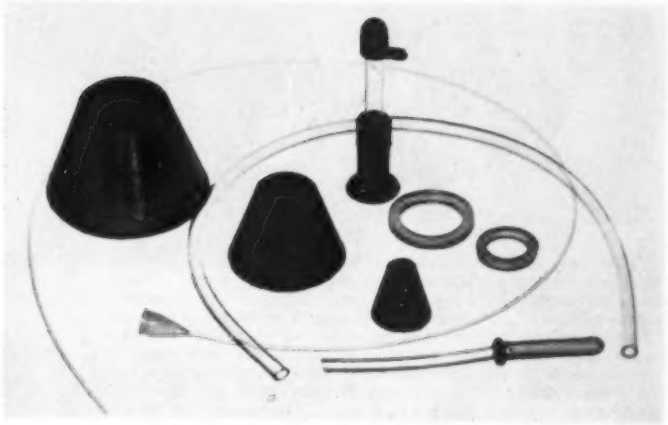


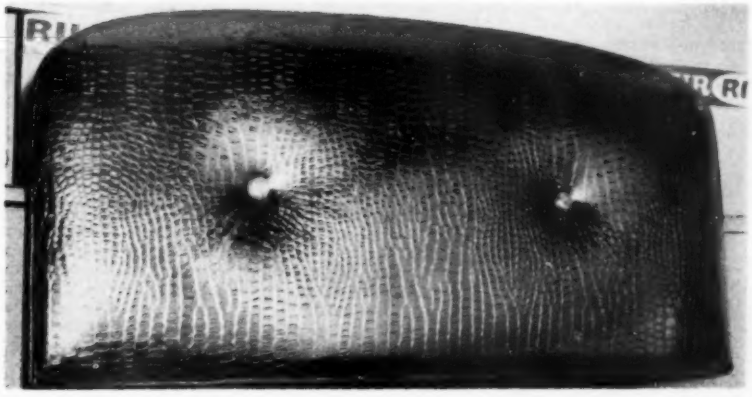
Sponge rubber requirements for every field of industry are a speciality of the company, which is also well known for its rubber and resin rubber shoe soling, available in sheet and in units. Manufactures, some illustrated, include sponge sheets, gaskets and seals for the motor industry; sponge rubber bath and gym mats and knee pads used by miners in the UK and overseas. **Volcrepe Ltd., V.C. Works, Glossop, Derbyshire.**



High quality precision technical mouldings for industry, in the UK and overseas, is the specialist province of this company. The chair arm rest, supplied to Amalgamated Dental Engineering Industries Ltd., has a right-hand ' mate ' without the flange but made in the same mould. Also illustrated is the cover and base supplied to R. B. Pullin & Co. for their ' Plugstat.' **Metropolitan Plastics Ltd., Faraday Way, St. Mary Cray, Orpington, Kent.**

The company are large-scale manufacturers of laboratory and hospital sundries, making these by compression and injection moulding and extrusion in various rubber and plastics materials. Their sterilizable vinyl tubing is used widely for blood transfusion and in heart-lung machines. Illustrated are new products introduced this year, including dispensers, silicone rubber rings, red rubber filtering cones, canulae for intravenous injections and sputum pipettes. **Esco (Rubber) Ltd., 34-36 Somerford Grove, London, N.16.**



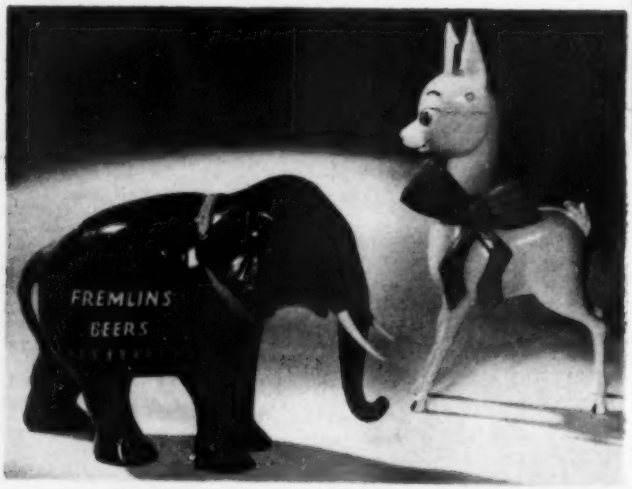


Newly introduced by the company is 'Rilsheen' PVC sheet in brilliant metallic colours: gold (shown here), silver, red, blue and red-gold. It is supplied in 30-yd. (9.1m.) rolls, 46-48in. (116-122 cm.) wide. Among many other products is 'Rilquilt' quilted PVC available in the same widths as above, plain or patterned in a full range of colours. It is laminated to polyurethane foam, backed or unbacked. **Rubber Improvement Ltd., Rilex Works, Wellingborough, Northants.**

The company specializes in precision rubber mouldings—' O ' rings, gaskets, seales, etc., in natural and many synthetic rubbers; mouldings with metal inserts and extrusions to close limits; cold cast rubber, as the Phillips Craftsman shown; and seamless latex products, bladders, valves, etc., for sports goods, and ' Met ' balloons capable of altitudes of 100,000 ft. and over. Dipped latex goods include pressure tubing, hospital masks and grips for sports goods. **Guide Bridge Rubber Co. Ltd., Vulcan Mill, Butcher Lane, Bury, Lancs.**

After only four years in the export business the company now sells to 30 different countries. Mattresses, carpet underlay, cushions and bus seats are the main items in their export trade, with the recently introduced Vitaweb rubber webbing making headway in West Africa, Sweden, Holland, Cyprus and the Middle East. A fair proportion of Vitafoam mattress exports go to the tropics, especially the West Indies. Other, but 'hidden' Vitafoam exports are in the seats of scooters, many British cars and nearly all British motor-cycles. The company has a depot in Western Germany, where they trade under the name of Vitaschaum. This means that Vitafoam have a foothold in the Common Market, as well as the EFTA. **Vitafoam Ltd., Don Mill, Middleton, Manchester, Lancs.**

This company specializes in a wide range of extruded and moulded rubbers manufactured to clients' requirements. Stock lines are known under the trade name 'Britannia' for the motor, motor-cycle, cycle, perambulator and sports trades. The range of 'Shaped' radiator hose connections covers all popular British cars and vehicles and certain Continental models. A wide range of rubber bands is also manufactured. The illustration shows a cycle inner tube, a 'Shaped' and a 'Convoluted' radiator hose connection, a motor car fan belt and an assortment of rubber washers. **The Lee-Healey Co. Ltd., Marlow Road Mills, Leicester.**



The Baby Cham and the elephant have been produced by an associate company, Mica Products Ltd. These two samples are from a range of injection moulded advertising models and are based on the customers existing trade marks. The basic mouldings are produced in polystyrene; they are then assembled and painted to follow closely the customer's original design. All work, from the tool design and manufacturing stage to the final finishing is normally carried out in the company's own works, and if necessary, assistance is given in preparing the initial design in line with the customer's requirements. The Baby Cham was produced for Showerings Ltd. and the elephant for Fremlins Brewery Ltd. **Crystalate (Mouldings) Ltd., Crystalate House, Mill Lane, Tonbridge, Kent.**

This company has been supplying and erecting plastics rainwater goods since 1958 and was the first company in the UK to do this. A new method of fastening gutters has been developed. The 'LaBrec' system makes it possible for builders to undertake installations themselves without fear of failures from thermal stresses. The company can also offer a service for supplying and installing industrial plastic rainwater goods, including plastic liners for repairing existing installations and chemical and air conditioning ducting. **LaBreque Engineering Co. Ltd., Gaywood House, Gayfere Street, London, S.W.1.**

One of the almost limitless uses of rubber adhesives — fixing sound-deadening pads in a car body

Rubber Adhesives

TREMENDOUS ADVANCES IN TECHNOLOGY AND USE

By N. G. BASSETT SMITH

ABOUT 8,000,000 gallons of rubber based adhesives were manufactured in the UK alone in 1959, compared with 2,000,000 in 1956. This four-fold increase in production has been due not only to the expansion of previous fields of application, but in no small measure to rapid advances in the technology of rubber based adhesives which have made possible their extension into new fields. The availability of new raw materials, concurrently with continued pressure from the user industries, in particular the car industry, for higher standards of performance, has resulted in developments which could never have been envisaged by the adhesive technologist of twenty years ago. At that time the principal applications of rubber based adhesives were in the manufacture of rubber products themselves, such as tyres, rubber footwear and other moulded products. In making these articles it was usual to use adhesives consisting of petroleum solutions of natural rubber or of the vulcanized rubber compound used in manufacturing the article itself. Other important applications were in the seaming of waterproof clothing, and in shoe manufacture, where in addition to rubber sole attachment, they were used to provide temporary attachments of various parts of the shoe prior to sewing. Nowadays, rubber adhesives are everywhere. Their field of use has been widened to a great extent by the availability of new types of synthetic rubbers, and at the same time adhesive manufacturers themselves have not been slow in making full use of the potentialities of new compounding ingredients to develop a range of products of outstanding versatility and reliability.

Rubber based adhesives, and in this context the word 'rubber' is used to embrace a range of flexible and extensible polymers, have special properties which have contributed to their rapid extension into many fields of manufacturing industry. The self-adhesive tack of a dried rubber film, which enables two coated surfaces to be brought together and united to each other but not to other surfaces under slight pressure, is made use of in self-sealing envelopes, which are usually coated at high speed by transfer roller technique from natural latex containing antioxidants and preservatives. These additions to the latex must be carefully chosen if the self-adhesive properties of the latex adhesive are to be unimpaired in prolonged storage. The same principle is made use of in the manufacture of self-erecting cardboard cartons which are supplied in the flat and made up as required. Here it is essential that the board used should be free from copper compounds, which may have a deleterious effect on the ageing of the adhesive, reducing it in the worst conditions to an oily sticky film with no cohesive strength.

Resistant to Attack

Rubber based adhesives are inherently more resistant to the attacks of bacteria and moulds than are the traditional vegetable and animal glues, and they are also much less susceptible to changes of temperature and humidity. They are therefore used to a considerable extent in packaging, carpet binding and seaming where they replace these materials. Here they are usually used in the latex form, where the water content helps to provide a degree of penetration which reinforces the bond. For these purposes, and particularly where a quick 'grab' is required, water emulsions of solvents are often added. These make the rubber more tacky and assist in securing a rapid bond, as they cause the latex to coagulate under pressure when used in the correct proportions. This principle forms the basis of many of the house-

hold latex adhesives which have been put on the market in recent years.

Latex Adhesives

The durability of bonds obtained from latex adhesives, like those from solutions, can be appreciably improved when they are vulcanized. A vulcanizing latex adhesive is usually supplied in two parts, one containing the rubber latex together with any softeners, antioxidants and reinforcing fillers required, and the sulphur necessary for vulcanization, the other being a water dispersion of the zinc oxide and vulcanization accelerator. Shortly before use the two parts are blended to give the correct proportions necessary for vulcanization. The blended latex is then applied to the materials to be bonded, dried and heat vulcanized in the normal way. If a one part vulcanizing latex is desired, a suitable choice of vulcanizing and compounding ingredients may enable the slow vulcanization which takes place even at normal temperature to be retarded so that little vulcanization takes place in 4—5 weeks, but the rate of cure at normal curing temperatures is almost unaffected. This type of compound provides the rubber backing for tufted carpets, where it not only anchors the pile but contributes in no small measure to the necessary 'handle' of the product.

Latex adhesives have special advantages as regards penetration, lack of flammability or toxicity, and comparatively high solids content, and they are also easily applied by spraying, spreading or roller coating methods. Their water content, however, makes them slow drying and for this reason they are unsuitable for modern manufacturing operations. Where speed of drying is needed, solvent based adhesives are used, and in fact these form by far the largest proportion of rubber adhesives used in industry. Suitable choice of solvent makes possible a wide variation in drying rates, and adhesives can thus be tailored to meet any production line requirements. Lightly compounded solvent based adhesives are still widely used in the shoe industry, and in many operations in the car upholstery trimming and leather fancy goods trades where ease and speed of application are vitally important, and a moderate bond strength is sufficient.

In all these applications, an important attribute of rubber adhesives is the flexibility of the bond produced, which not only permits of joints being made between flexible materials without any appreciable increase in stiffness, but also allows the uniting of dissimilar materials which may have different coefficients of expansion due to temperature and moisture absorbtion.

One of the biggest users of rubber based adhesives in this country is the motor industry. The average car uses about one gallon of rubber based adhesives for the upholstery, attaching roof lining, trimming wheel arches, attaching sound deadening material to the body and sticking down carpeting to sills and propellor shaft covers. Here there have been rapid developments within the last few years. Whereas ten years ago all the adhesives used in the industry were based on natural rubber or reclaimed rubber, now neoprene based adhesives have replaced them to a considerable extent, in spite of higher costs. In many cases too, mechanical methods of fixing have been superseded by adhesives. For example, the clips used for attaching weatherstrip round car doors and boot lids have now been almost entirely replaced by rubber adhesive bonding. This is because the improved ageing and heat resistant properties of neoprene and neoprene resin adhesives enable them to meet with-

THE AUTHOR

N. G. BASSETT SMITH, F.I.B.C.M., is General Manager of Dunlops Chemical Products Division.

He joined Dunlops in 1927 and in 1939 was appointed Manager, Rubber Wing Division. On returning from the Army, with the rank of Lt.-Col., he was appointed Sales Manager of the Compositions Division and, in 1957, General Manager. (The Compositions Division was renamed the Chemical Products Division on June 1, 1960.)

Mr. Bassett Smith, who is fifty, is Chairman of the British Rubber and Resin Adhesive Manufacturers Association; a Council member of the Federation of British Rubber and Allied Manufacturers and of the Institute of British Carriage and Automobile Manufacturers.

The self-erecting cartons in the top picture use self-sealing rubber latex adhesive. In the lower picture, brush setting adhesive is applied by pressure gun

About 8,000,000 tons of rubber based adhesives were manufactured in the UK in 1959. Its uses are legion but current research into new adhesives with still further improved qualities will mean ever-increasing use in many manufacturing industries

out difficulty the increasing demands, particularly of the export market. A recent development in the industry is the increasing use of 'one-way stick' adhesives for carpets and sound deadening felts.

With the development of newer types of decorative surfacing materials, based mainly on synthetic resins, such as Formica, Warerite and similar products, a demand has arisen for a powerful adhesive again with a good degree of heat resistance. Here again, the properties of neoprene adhesives enable them to meet this requirement. A solvent based adhesive modified by the addition of tackifying resins is usually used, applied to both surfaces to be joined, allowed to dry completely and then pressed together. Self-adhesive tack enables a strong bond to be made. This technique is widely applied in the shop fitting trade where these laminates are used for the working surfaces of counters and tables.

While correctly compounded neoprene adhesives are sufficiently heat resistant to meet the applications already described, they are sufficiently thermoplastic at higher temperatures to permit heat sealing. This property has made possible the rapid development of new methods of shoe manufacture. The old method of sole attachment by stitching has been replaced by the so-called 'infra-red' process. A non-vulcanizing neoprene adhesive is applied to both the sole and upper of a shoe, and allowed to dry completely. The two parts are then reactivated by heating under 'infra-red' lamps for a brief period and immediately brought together under pressure. The bond so formed is flexible and sufficiently heat resistant to withstand any temperatures likely to be encountered in normal usage. This type of adhesive is usually compounded with magnesia and zinc oxide in order to prevent the liberation of traces of hydrochloric acid from the neoprene which might rot the fabrics to which it has been applied, and to prevent discoloration of the adhesive.

While the proportion of neoprene adhesive used in industry has increased steadily during the last few years, and is likely to increase further as neoprene becomes cheaper due to indigenous production, there are still wide fields of application where natural rubber reigns supreme. In pressure sensitive adhesives, for example, used in surgical and industrial tapes, natural rubber compounded with zinc oxide and soluble resins such as polyterpene resins, hydrogenated or esterified wood resins, or even wood resin itself is used. The effect of increasing resin content is to increase the adhesive strength at the expense of the cohesive strength of the adhesive, and careful formulation is necessary to obtain optimum properties, which also depend upon controlled mastication of the natural rubber used. For cheaper adhesives where specific adhesion to metal or concrete surfaces is required, and a light coloured adhesive is not necessary, reclaim rubber forms a useful basis.

Polyisobutylene is a synthetic rubber which has enlarged its area of

Continued on page 631

Colouring of Plastics

PROCESSING PROPERTIES OF PIGMENTS

By C. MUSGRAVE

PIGMENTARY colours used in the colouring of plastics fall into two groups: inorganic and organic.

Inorganic pigments are those in which the metallic radicle predominates; the more important members are classified in Table 1.

Organic pigments vary widely in their structures and an understanding of them is hampered by the lack of a universal terminology to describe the groups involved. Table 2 puts forward a classification which, it is hoped, will be of assistance to the plastics technologist.

The properties shown by a pigment in plastics materials depends on the nature of the plastics composition as well as the structure of the pigment in question. The relative importance attached to one or more of these properties is determined by the application and by the conditions to which the finished product is subjected during service. Therefore, while it is possible to group pigments together roughly according to their similar chemical structures and to generalize on the properties they can be expected to show, it is evident that many exceptions will arise. The following observations, concerning some of the more important properties required of pigments for plastics, are made with these reservations in mind.

THE AUTHOR

CLIFFORD MUSGRAVE, A.M.C.T., is a native of Manchester and was educated at the Manchester College of Science and Technology. He later studied plastics technology and subsequently became a part-time Lecturer in this subject at the Newton Heath Technical College, Manchester. He joined the Plastics Laboratory of the Geigy Company in 1933 *and, after a period of war service with the Ministry of Supply, returned to Geigy, where he is now Head of the Plastics Colour Laboratory. In this capacity he is intimately concerned with the development and evaluation of colouring materials and other additives for use with plastics and rubbers.*

Stability to Processing

Stability to processing is usually referred to as the heat stability of the pigment but is more correctly the heat stability of the whole system. Inorganic pigments are expected to show the greatest degree of heat stability and by and large they do, provided there is no interaction between the pigment and the constituents of the composition. A good example of this are the ultramarine blues. These will perform adequately in inert or basic media, but should acidity develop the colour is discharged. Organic pigments generally do not withstand the highest temperature encountered in processing certain plastics, for example polystyrene and polypropylene, although a limited number, such as the metal complex pigments and the quinacridone, carbazole and certain anthraquinonoid vat colours are quite satisfactory. The reactive nature of the plastics is again of profound importance with organic pigments, especially the metal toners. Here there is always the possibility of ion exchange, particularly if an alkali such as sodium carbonate or calcium carbonate is present in the compound. This situation often arises in PVC plastics when residual sodium salts or deliberate additions of sodium carbonate as stabilizer lead to shade variations when metal toners are used. Since the shade change is accelerated at elevated temperatures, it is often considered to be an example of poor heat stability. Generally the heat stabilities of the various pigment groups can be taken in the following (decreasing) order: inorganic pigments, metal complex pigments, vat pigments, metal toners and lakes, organic pigmentary colours — disazo, organic pigmentary colours — monoazo.

In practice it is found that inorganic pigments, metal complex pigments and vat pigments will withstand processing in most plastics compounds, even when temperatures reach as high as 300°C., for example in the case of polystyrene and polypropylene. The metal toners and disazo organic pigmentary colours are more suitable for PVC applications, cellulose plastics and thermosetting resins where temperatures above 180-200°C. for short periods are seldom exceeded. Because of

Table 1

Group	Chemical Type	Spectrum Coverage
Iron pigments	Oxides of iron, naturally occurring and synthetic	Yellows, browns
Chrome pigments	Lead and lead molybdenum chromates	Yellows, oranges
Cadmium pigments	Cadmium sulphides, cadmium sulphoselenides	Yellows, oranges, reds, maroons
Ultramarines		Blues, violets

Table 2

Group	Chemical type	Spectrum Coverage
Organic pigmentary colours	Organic pigments not containing metals or sulphonic acid groups; mainly mono and disazo pigments	Predominantly yellow, orange, red, maroon
Metal toners	Metal salts (usually Ca, Ba or Mn) of sparingly soluble sulphonated azo dyes	Mainly reds, maroons
Metal complex pigments	Metal containing organic pigments in which the metal is chelated	Yellows, greens, blues
Vat pigments	Organic pigments of the anthraquinonoid, indigoid, carbazole and quinacridone types	Full spectrum, but blues, violets and reds of greatest interest
Lakes	Water-soluble acid dyes precipitated on to an inert substrate	Full spectrum

their still lower order of heat stability, plus a tendency to chalk in plasticized media, monoazo pigments are generally confined to use in urea and phenolic plastics, polyester resins and linoleum.

Light stability

Stead and Smith maintained (*Journal of the Oil and Colour Chemists' Association*, No. 405, Vol. xxxvii, March 1954) that there is no such property as the light stability of a pigment, only of a pigmentation. This view, supported by ever-increasing evidence, is now accepted, and it follows that although certain groups of pigments are credited with great permanence, they should always be evaluated in the plastics compound concerned and at the desired concentration, since light stability is proportional, but not necessarily directly proportional, to the amount of colour present. Other factors, such as opacity and the amount of titanium pigment present, are also important, especially the latter because of possible photochemical degradation.

The assessment of light fastness in plastics is often made difficult by the instability of the plastics compound itself. For instance, most PVC compounds bleach slightly on initial exposure and create the impression that the pigment has faded. In other cases, such as phenolic plastics and, to a lesser extent, certain polyester resins, darkening of the base occurs. It is therefore necessary to continue exposure after the first fade has been observed in order to determine the practical light fastness of a particular pigmentation. It is sometimes desirable to determine the effect of base change on overall colour stability and this is best achieved by submitting the exposed and unexposed uncoloured base, together with similarly treated coloured patterns, to reflectance measurement in a spectrophotometer or differential colourimeter, and plotting the CIE co-ordinates.

Bearing in mind these reservations, a large number of practical tests in various plastics have shown that the expected light stability of the various pigment groups tends to conform to the following pattern: inorganic pigments, metal complex, vat pigments — highest order of light stability; organic pigmentary colours — moderate to very good stability; metal toners — poor to very good stability; lakes — poor to moderate stability.

Chalking

The well known defect of colour appearing on the surface of a plastics on ageing, variously termed 'chalking,' 'blooming' or 'crocking,' is almost entirely restricted to thermoplastics, as is the associated problem of colour migration. Here the colour is found to mark off on to other plastics with which it is in contact. It is now agreed that both phenomena are dependent to some extent on the solubility of the pigment in the plastics compound and since solubility is dependent on the nature and temperature of the solvent, chalking and migration are influenced by the composition of the plastics and the processing conditions. A second influencing factor is the size and complexity of the pigment molecule, since the larger and more complex the structure the more restricted is its movement within the mass. Numerous practical studies have shown that the various pigment groups can be expected to behave as shown in Table 3.

Table 3

Inorganic pigments	Non-chalking	Non-migrating
Metal complex pigments	Non-chalking	Non-migrating
Vat pigments	Non-chalking	Some migrate
Monoazo pigments	Chalk	Migrate
Disazo pigments	Non-chalking*	Some migrate
Metal toners	Non-chalking	Some migrate
Lakes	Non-chalking	Non-migrating†

*Except at low concentration in highly plasticised media
†Depends on the nature of the soluble dyestuff used

Because of the growing importance of the vinyl plastics for floor covering, mention should be made of the alkali stability of pigments. Alkaline fillers are generally used in these compounds and it is common practice to lay vinyl tiles on concrete surfaces which give rise to alkaline sweat. Colours most readily affected are the inorganic chrome pigments and the metal toners and for applications where alkali is encountered, particularly in service, such pigment groups should be omitted or submitted to very stringent tests before bulk use.

Effects on properties

In addition to the stability of a pigmented plastics system, which, as already discussed, is a function of a variety of factors, the incorporation of pigments is sometimes directly responsible for modification in the properties of the plastics. Some of the effects are of a physical nature while others are chemical. For example, the use of standard qualities of coloured pigments at about 1% concentration per hundred of resin in plastics intended for cable insulation will invariably reduce the volume resistivity of the compound by one or more powers of ten, from, for example, 1×10^{14} ohm. cm. to as low as 1×10^{11} ohm. cm. This drop in volume resistivity can be avoided if specially purified grades of pigment free from ionizable material are used. The use of such pigments is economically attractive, since it makes possible the formulation of less expensive electrical grade compounds through the use of lower cost plasticizers and extenders.

The addition of carbon black has an even greater effect upon the electrical properties of the plastics compound, and this is frequently used in the preparation of so-called antistatic grades of plastics, for example coalmine belting. On the other hand, the increase in conductivity of the compound, due to the carbon black constituent, can be a source of trouble especially in PVC film and coated fabrics, which are subsequently subjected to electronic welding due to arcing across the electrodes. Where this occurs, it is advisable to use an alternative pigment such as aniline black. By the choice of a suitable grade of pigment it is therefore possible to influence the electrical properties of the end product to a useful degree.

A more difficult problem to overcome is poor surface finish, which occasionally results from the use of otherwise satisfactory pigments. This defect is most commonly observed in extruded sections, especially in unplasticized PVC usually as a loss in gloss, and can sometimes be so severe as to cause a real drop in the impact strength of the final product. Reaction between the pigment and the plastic cannot be discounted, although it is evident that the particle size, and hence the surface area of the pigment, is one factor, since pigments of high surface area, for example carbon black, are most frequently cited. As the aim of the colour maker is to produce pigments of the finest possible particle size it is difficult to find an answer to this aspect of the problem.

The properties of polyester resins and epoxy resins are often modified by the choice of colouring materials due, in the main, to reaction between the colouring material and either the catalyst or the resin itself. For example, the phthalocyanine colours

(metal complex pigments) are attacked by oxidizing agents and they therefore tend to remove some of the active oxidizing catalyst from a polyester resin system, resulting in a retarding of the cure, the degree being dependent upon the quantity of pigment present. Acceleration of the cure takes place with other colouring materials, especially those containing phenolic and amino groups. Even with a knowledge of the chemical constitution of the colouring material under consideration, it is not yet possible to forecast with any certainty the effect of specific pigments upon the various commercially available polyester and epoxy resins, and once again trial and error methods have to be used.

Mention has already been made of the danger of using iron pigments in PVC compounds, because of their degrading effect on the polymer on exposure to light. However, it must be noted that breakdown does not invariably occur and that if the system is well stabilized it may perform adequately in service. This will also depend upon the grade of polymer, since the rate of decomposition is greater with some grades than with others. From the author's limited observations, it is not a simple difference between granular and emulsion types, since degradation has been observed with both.

Mixing and applications

The majority of plastics are coloured in the mass, often by mixing the dry powder pigment with the constituents of the plastics and fluxing the whole until homogeneous in an internal mixer, roll-mill, extruder or other suitable equipment. Since compounding times are often limited in duration for technical as well as commercial reasons, it follows that the pigment must be in a finely divided state and of soft texture if good dispersion is to be achieved.

Certain applications however do not readily permit the use of a dry pigment, for example leathercloth produced from PVC paste by the spreading technique. Here it is necessary to predisperse the pigment in a suitable vehicle, and the standard practice is to use a plasticizer. Polyester resins also require the pigment in a predispersed form, and similarly the polyurethane foams. For the latter water is the chosen vehicle and special pigment / water dispersions are produced for this application. The introduction of the so-called 'dry - tumbling' technique, often applied to the colouring of polystyrene, has even further emphasised

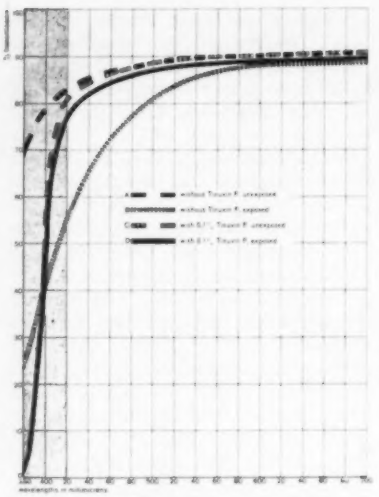


Fig. 1. Polyester resin sheeting exposed to six months sunlight in Florida. Curves measured by General Electric Recording Spectrophotometer. Horizontal axis: wavelength in millimicrons; vertical axis: % of transmission

the limitations of pigment powders, while the newer polyolefines, especially high density high melt index polythene and polypropylene, are particularly difficult to colour, even when the most vigorous compounding methods are used. This is partly due to the inability of these polymers to wet out the pigment powder and partly to the lack of shear due to their low viscosities at the compounding temperature. The problem can be partially overcome by producing masterbatches of the pigment in polyolefines, but it frequently happens that the severity of the mixing procedure not only brings about some breakdown of the pigment but also of the polyolefine itself. Recent developments by the colour manufacturers have produced a range of specially treated pigments which do not aggregate during compounding and will disperse readily, even when the dry-tumbling process is used.

Basically, therefore, colouring materials must not only possess the desired shade and stability characteristics but must be available in the correct physical form suitable for the particular application.

Ultra-violet absorber

It is now well established that many polymers suffer degradation through cross linking, chain scission or oxidation when exposed to wavelengths in the ultra-violet range of 300–400 millimicrons. However, protection can be afforded by the incorporation of substances which will preferentially absorb these damaging wavelengths and re-emit the energy in a non-destructive form, for example as heat energy. Such substances, known as ultra-violet absorbers or barriers, must be compatible with the plastics concerned, stable to the processing conditions and extremely fast to light. In order not to impart colour to the plastics, it is desirable that no absorption above 400 millimicrons should take place. Ultra-violet absorbers are now being used more and more for the protection of polystyrene, polyester resins, PVC and polyolefines. Con-

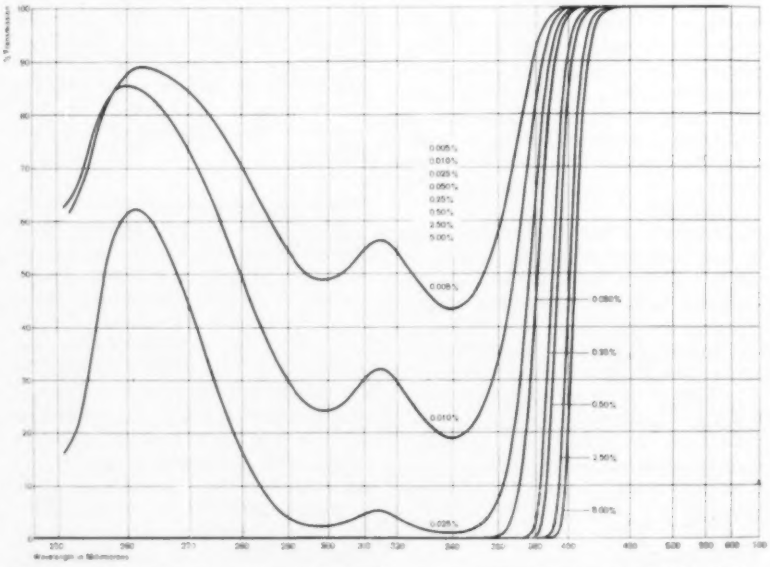


Fig. 2. Absorption curves of Tinuvin P for ultraviolet and visible light. Horizontal axis: wavelength in millimicrons; vertical axis: % transmission

centrations generally vary from 0.01% to 0.5% on the weight of resin, depending on the degree of protection required and the efficiency of the chosen absorber. Those now in commercial use are mainly derivatives of benzophenone or benzotriazole. The graphs illustrate the absorbing power of a benzotriazole type ultra-violet absorber (Tinuvin P) and the effectiveness of this product in preventing the darkening of polyester resin on exposure to strong sunlight.

New developments

Great progress has been made by the plastics industry during the last 20 years in developing entirely new polymers and modifying existing ones. Running parallel have been improvements in techniques of processing these materials, and new types of compounding and finishing equipment have also emerged.

All this activity has stimulated research and development within the pigment manufacturing industry. This has roughly followed two courses: first, to bring about improvements to existing pigments and to re-evaluate many of the older brands for the new plastics materials. Improvements in migration, light and heat stability have been made with existing pigments by modifications to the production processes, and although there is obviously a limit to the extent of these improvements, worthwhile results have been achieved. This is especially true of the phthalocyanine blues, where their indifferent heat stability in certain plastics has led to modification of the qualities.

The need for pigments in different forms has been studied, and from this work have come products varying from simple dispersions in media such as water or plasticized, to the more difficult type of preparation of specially treated pigments designed for specific polymers, for example to give better dispersion in polyurethane.

The second course followed has been basic research aimed at the discovery of completely new chemical structures. Examples of fruitful results in this field are the nickelazo yellow and the quinacridone reds.

'The Chemical Industry — Canada and the USA,' with special emphasis on the problems facing the industries in the two countries, will be the theme of a one-day conference sponsored jointly by the Chemical Institute of Canada and the Commercial Chemical Development Association, of the USA. About 300 representatives are expected to attend the meeting in Montreal on October 18.

RUBBER ADHESIVES Continued from page 627

application, literally, in recent years. Its extremely good ageing properties, even in thin films exposed to light, make it particularly useful for such applications as pressure sensitive labels, window bills and similar products, where these properties more than outweigh its additional cost. In these adhesives, a high molecular weight polymer is used as the basis, modified with lower molecular weight liquid polymers which have the advantage over oil plasticizers that they do not 'bleed' through the paper.

Similar adhesives based sometimes on polyvinyl ethers and compounded frequently with tackifying resins, have made possible the many types of self-adhesive PVC patterned sheeting which are widely used for decorative purposes and are now making possible the development of new wall covering materials. Adhesives of this type are also being successfully used for the backing of thin plastic wall tiles. These are sold with a protective paper backing which is stripped off, and the tile immediately applied to the wall.

A problem which occurs especially when joining flexible plastic materials, is plasticizer migration, from the plastic into the adhesive. This may result in softening of the adhesive bond and at the same time the plastic itself may be stained by ingredients migrating from the adhesive. This difficulty is avoided by the use of a butadiene-acrylonitrile copolymer as the adhesive base, compounded with phenolic resins or vinyl chloride-acetate copolymers, and reinforcing fillers such as calcium silicate.

A new development is the use of rubber based adhesives for attaching thin ceramic tiles. Here a light-coloured adhesive is required. Some of the early difficulties experienced with this type of fixing have highlighted the necessity, present in all adhesive applications, of considering the adhesive bond as a complete system in which the materials to be joined, as well as the adhesive itself, are of equal importance.

Enough has been said to show the extreme versatility of adhesives based on natural and synthetic rubbers. Space does not permit a detailed description of the various methods of application, brushing, spraying, trowelling, roller coating and pressure gun, which fit these adhesives into a variety of manufacturing processes. Research continues and it can confidently be forecast that products with even further resistance to oxidation, weathering, high temperatures, solvents, oils and greases will be available in the foreseeable future.

In closing, it is pleasing to add that in addition to the research carried out by all the adhesive manufacturers there is an excellent programme of work constantly handled as a team within the Technical Panel of the British Rubber and Resin Adhesive Manufacturers' Association. It is indeed the co-operation of members in tackling common problems together that has enabled the industry to show such excellent technical and commercial progress.

A new view of the International Synthetic Rubber Company's plant at Hythe, showing, for the first time, in the foreground, part of the new high solids latex plant, now in full production

Polymers in the Motor Industry

By A. E. BRAY

IF large industries such as the motor industry and the plastics and rubber industries are to derive the maximum benefit from each other, they must not be in ignorance of each other's requirements, limitations and potential. In this article some of the lesser known yet very important requirements for plastics and rubber components used by the motor industry are expressed. The subject is a very large and complex one and therefore can only be considered in general terms. Very seldom in service do any of the factors mentioned occur separately, but in varying combinations and degrees, often put under the umbrella terms of weathering and ageing.

It is assumed that people in the industries concerned are familiar with the essential economic considerations and the usual mechanical strength properties. While most of the factors apply to both rubbers and plastics, the emphasis is on the plastics industry since the rubber industry has the benefit of many years of experience.

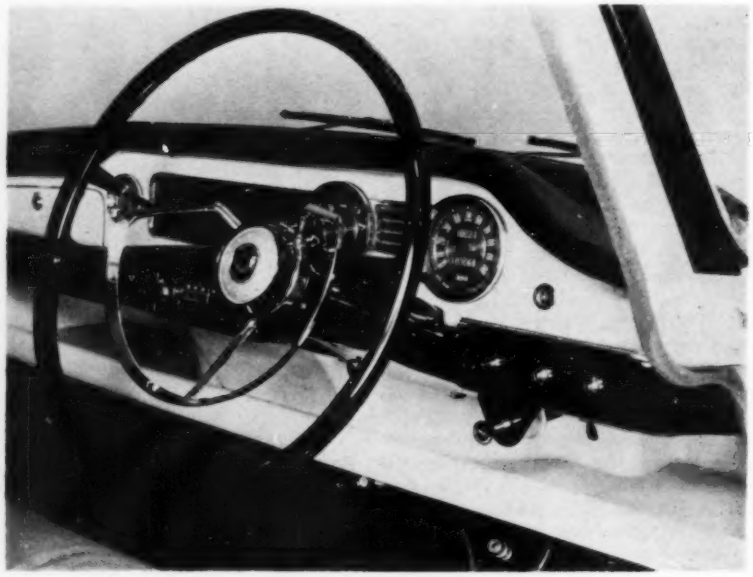
To set the scene in the motor industry, a product is made containing a remarkable number of different materials, some in many forms. This product is made in vast numbers, the British Motor Corporation's latest production figures alone for the past twelve months being nearly 700,000 vehicles. The quantities of components are astronomical, particularly when the whole industry is considered. A car designer, however brilliant, cannot possibly cope with all the materials available, particularly the many plastics and rubbers that seem to be developed at the same rate as cars are made.

Principally for economic reasons the motor industry does not carry large stocks so that there is a certain amount of ' hand to mouth ' existance. Despite all the inspection carried out there still has to be some faith in the component suppliers. This faith is strengthened if it is known that the suppliers are aware of what the component is expected to do both during the production and service life of the vehicle.

The service life of any vehicle can vary depending on how and where it is used, but the government has given some indication by the introduction of the compulsory examination for vehicles over ten years old.

Temperature and Humidity

When a motor-car is made there is nothing to indicate where in the world it will do service, from the sub-zero regions of North America and Scandinavia to the hot steamy jungles of Malaya and Africa or the hot dry regions of the Middle East. In Table 1 are shown shade temperature and humidity ranges taken from meteorological records over a twenty-five year period 1923-1948, for a representative world coverage of tropical and sub-tropical areas. While these values are extreme limits they do



Facia panel of a modern small car showing many plastic components including knobs, steering wheel and the crash pad, which is subject to very high temperatures just inside the windscreen

THE AUTHOR

A. E. BRAY was educated at Loughborough Grammar School and by part-time study at Derby Technical College, whilst serving as a laboratory assistant in the Rolls-Royce Research Laboratories from 1938-46, *where he worked on rubbers used in aircraft engines.*

After a brief diversion into the chemical stoneware industry, he joined Morris Motors Ltd. in 1946 *to assist in the examination of rubber components used in the industry. He is now Senior Investigator on Non-Metallic Materials in the Nuffield Central Research Laboratories, responsible for the testing and examination of a wide range of materials and for writing many of the appropriate performance specifications. He is a member of the SMM and T Non-Metallics Sub-Committee and a number of BSI committees.*

Table 1

ATMOSPHERIC CONDITIONS IN TROPICAL AREAS
(from Meteorological Observations, 1923-48)

	Temperature Range °F.			Associated Humidity % R.H.		Humidity Range % R.H.	
	Max.	Black Bulb	Min.	Max.	Min.	Max.	Min.
Australia:							
Alice Springs ..	117		23	21	49	51	19
Melbourne ..	111		27	48	84	84	48
Port Darwin ..	105		56	52	62	80	43
India:							
Allahabad ..	120		36	43	88	91	17
Karachi ..	118		39	62	78	88	36
Calcutta ..	108		44	71	87	92	44
Burma:							
Rangoon ..	107		55	75	85	92	50
N. Africa & Egypt:							
Alexandria ..	111	153	37	68	66	90	50
Khartoum ..	117		41	29	43	59	7
Algiers ..	107		32	60	69	75	57
Africa:							
Entebbe ..	89		52	61	97	99	54
Lagos	104	163	60	69	96	98	60
Cape Town ..	105		32	46	95	95	43
South America:							
Georgetown ..	92		68	73	88	93	69
Puerto Madryn	103		11	43	73	74	41
Buenos Aires ..	104		22	61	92	92	60

show that wide temperature and humidity ranges occur in the same area. Imagine the temperature in the sun in Allahabad if it can reach 120°F. in the shade, or Calcutta where there is an associated relative humidity of around 70%. Although no values are quoted for the colder regions of the world, temperatures of -40°F. are quite common during a North American winter.

From time to time investigations have been carried out to determine the temperatures reached by different parts of a vehicle left out in the sun and a summary of some recent work is given in Table 2.

It is interesting to see that with an exterior body temperature of 150°F. the enclosed air in the car can be 20°F. higher and the trim surface temperature higher still. Even in England, which is considered to be very temperate, interior trim temperatures reach 150°F. The trim covering affords some insulation to the materials underneath, but nevertheless fairly high temperatures are recorded even under fluting and one inch of latex foam. What the characteristics of latex foam are at these temperatures, one doesn't really know, indications being that certain processing ingredients give much reduced strength. Welded trim also shows indications of reduced strength at these service temperatures, but these fields of investigation have yet to be fully explored.

The thermal absorption of different materials and particularly different colours, appreciably influences the temperature values. In the engine compartment one must allow temperatures at least 30°F. higher than in the passenger compartment. Work both in the USA and on the Continent have confirmed these temperature limits.

Service temperature requirements are therefore -40°F. to 230°F. for the engine compartment components, -40°F. to 200°F. for the interior body fittings and -40°F. to 180°F. for the exterior body fittings.

The relative humidity can range from 0 to 100% at the same time. During assembly of vehicles there is occasional damage to paintwork that has to be rectified prior to the car leaving the factory. The whole vehicle then has to go through the 'hospital' line ovens where the temperature is in the range of 190-210° F. for periods of 40-60 minutes. Naturally in this short time the interiors of saloon cars do not achieve the temperature, but open vehicles may.

It is most frequently the initial heating of a plastic component that causes most trouble, since the heat relieves trapped stresses from the processing and causes distortion and/or shrinkage effects that are permanent. In conjunction with oxygen or oxidising atmospheres the heat can cause breakdown of the surface and loss of mechanical properties.

Further Requirements

With the majority of plastic components in a motor-car the aesthetic considerations are of prime importance so that any big change in surface appearance or colour cannot be tolerated, while small changes are undesirable. Colour fastness to light is well appreciated but compatibility of one material with another is not so well known. This can be the cause of staining or even mutual breakdown, as people who have used certain cheap plastic covers for their cars have learned at the cost of a paint re-spray.

Rubber compounds containing amine type anti-oxidants have given much trouble in causing staining of plastic trim and paint. Non-staining anti-oxidants are now called for,

Winter conditions simulated in a cold chamber. This and the Borneo photograph illustrate the extreme conditions to which a car may be subjected

while the SMM and T Standard No. 60 gives a test procedure for assessing a material's suitability on this point.

With the increase in the number of cars on the road, the increased use of plastic trim and the fashion for light pastel colours, other staining problems arise due to the sulphur compounds in industrial atmospheres. These can cause black staining of PVC compounds where lead stabilizers are used. Evidence has been found recently that exhaust fumes cause a particular type of staining to paintwork and it is feasible to assume that plastics are affected to some extent as well.

Over the past twelve months there have been some complaints from Los Angeles of the transparent flexible PVC, used for glazing in collapsible hoods, discolouring badly. It is well known that LA is unique for its high ozone and UV concentrations as well as its industrial smog. However, exposure tests of the flexible PVC in this area has failed to reproduce this trouble, but laboratory tests using detergents on the material and then exposing to UV radiation closely reproduces the discoloration. A possible, though unconfirmed explanation of the complaints is the rapid car valeting service now offered, where in less than five minutes the whole car, tyre side-walls included, is cleaned, detergents being used unsparingly. The vehicle is then exposed to the hot sun and trouble can be expected.

Table 2

VEHICLE TEMPERATURES, °F.

Location	Ambient Shade	Air in Car	PVC-coated Fabric Front Seat		Exterior Body
Japan:					
10.30 a.m.	86	118	120		118
11.30 a.m.	91	129	138		124
1.30 p.m.	93	129	145		136
Surinam, Dutch Guiana (black vehicle) (R.H. never drops below 77%) ..	86	170	175		150
		Crash Pad	161		
Buenos Aires	93	118	174		123
Aruba, Bahamas (black/grey vehicle) ..	87	122	Crash Pad 169	Grey	107
			172	Black	122
	88			Grey	126
				Black	146
Coventry (black vehicle, red upholstery):					
11.30 a.m.	73		131		104
12.00 noon	77		145		111
12.45 p.m.	79		147		109
1.30 p.m.	79		152		113

Black box, glass fronted with trim inside, put alongside vehicle at same time:

	Surface of Trim	Under Fluting	Under 1in. Latex foam
11.30 a.m.	142	126	104
12.00 noon	149	134	109
12.45 p.m.	145	143	136
1.30 p.m.	152	149	140

Car in North Borneo where temperatures in excess of 100°F. are normal

Soiling and Surface Friction

Associated with the heat, humidity and contact with other materials, are the properties of soiling and surface friction that apply principally to trim covering materials such as PVC coated fabrics and unsupported sheeting. The British Motor Corporation, which uses around a million yards of leathercloth a year, has had a domestic specification for this material since 1954. BS 2601 is being revised and a handbook of test methods for coated fabrics is approaching finality. However, some requirements need more research and soiling is one of them. The desire for light pastel shades, lightly embossed and having a matt finish has accentuated soiling. Applied surface finishes which impart a good degree of soil resistance, unfortunately give a glossy finish. The method of assessing the soiling resistance, which is being quite widely used now, is to rub a standard soiling cloth over the PVC surface using the Martindale Wear Tester. Experience is needed to make a decision on the test and much more work is needed on this important problem.

It is generally appreciated that the lower the coefficient of friction of the PVC surface the better the soil resistance. However the friction is important from a comfort angle as a high value in excess of 0.45 can be responsible for the driver's coat riding up his back or his trousers sticking to the seat when he wishes to adjust his position. Under the influence of UV radiation and/or heat, tackiness usually develops and an increase in the coefficient of friction greater than 40% makes a leathercloth unsuitable for use. The Dunlop Friction Meter is a useful instrument in determining the friction properties.

Fluid Resistance

A constant battle is going on between the materials technologist and the multitude of oils, greases, petrols, coolants, brake fluids and many others that flood the market. At the moment the rubber industry is more concerned with this trouble than the plastics industry, but this is only a matter of time.

Most of the oils and petrols contain many additives, while new methods of refining introduce new compounds into both the oil and petrol. Though these fluids give better performance the small amounts of these other chemicals present can

have drastic effects on synthetic rubbers widely used for oil and petrol resistance, namely the acrylonitrile and neoprene types. Premium grade petrols contain unsaturated fractions that over a period of a few weeks can oxidise into solvents having severe effects on the rubbers. The aromatic content of some petrols is as high as 45%-55% and this again limits the choice of materials for fuel lines, carburettor and petrol pump applications.

Lip seal rubbers which seal round rotating shafts, operate at temperatures around 120°C. under average conditions, but may reach 150°C. or higher. At this temperature they are in contact with extreme pressure oils of the SAE 90 or 140 rating. These oils usually contain sulphur and/or chlorine compounds that are accepted oxidising agents for rubbers. Why many nitrile compounds work under these conditions is sometimes a mystery but a factor which needs investigation is the effect of oxygen during running conditions. In some ways the advent of the fluorocarbon polymers such as Viton has given a good safety margin on both fluid and heat resistance, but the price is not yet low enough to allow universal adoption in the motor industry.

Cellular Materials

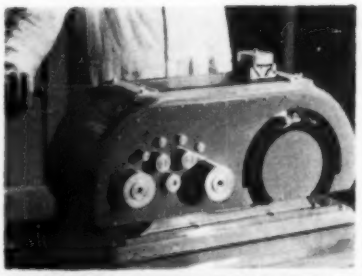
So rapid is the change in the field of rubber and plastic cellular materials that there is insufficient time to assess the characteristics of one before another improvement has replaced it. In the flexible urethane foams the past two years have seen the rise and decline of polyester foam in face of the polyether foam. Now there are hybrids of ester and ether, while the recent change from preformed polymer to the one-shot process has further complicated the scene from the users angle. Where does the designer step off so that he can use the material?

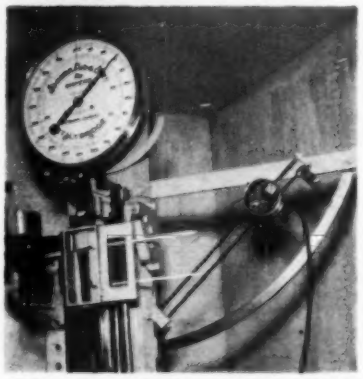
Latex foam has also undergone changes and partially to cope with increased demands the continuous foaming process is replacing the older batch or 'bowl and whisk' process. The change in process has produced a change in foam structure necessitating reassessment of characteristics, particularly tear resistance, to ensure the cushions can withstand the harsh treatment sometimes demanded of them. Synthetic latices are now appearing and showing price advantages but further technical worries.

The Future

The motor industry's future requirements of rubbers and plastics will depend to a large extent on the results of the technologist concerned with the assessment of the new materials. Pneumatic and hydraulic springing will be more prevalent, requiring flexible materials to resist not only normal ageing but a variety of fluids. Seats moulded as a complete unit in some suitable plastic, complete head linings and floor coverings vacuum formed, and adhesives to stick the body together, replacing spot-welding, are ideas and even possibilities in the near future.

The motor vehicle using air cushioning instead of conventional tyres for traction is a very real possibility while the pipe-dreamers even see the complete vehicle, engine and all, made from plastics.





(Top) **Hot chamber attached to tensile test machine used to determine the bond strength of adhesives at elevated temperatures.** *(Below)* **Dunlop friction meter being used to assess the surface drag of PVC-coated fabric**

Conclusions

Plastics applications in motor vehicles are increasing yearly, and the average English car uses at least 10lb. of plastic components in some 30-40 different ways. Rubber components are also more numerous, about 200 individual items in a small car, from tyres to small grommets the size of a pea.

The advent of glass reinforced plastics gave rise to revolutionary ideas in body construction. Mass production poses many problems to be overcome before these can be widely used. For sports cars having a small production rate and needing a high power to weight ratio there is a brighter future, while commercial vehicles, where finish is not so important as for private cars, are using more and more glass reinforcement. Experience gained on these vehicles will help solve the problems which are primarily cost, operation and cure time and poor paint finish.

Nylon gears are used for applications where the stresses are not severe, as in the speedometer pinion. Dissipation of heat from plastic gears under stress is a problem which must be solved before the all plastic gearbox appears, at least with polymers known today.

The motor and steel industries are closely related and at the present time steel is one of the cheapest materials available. Automobile engineers have been educated in metals and can call on at least 60 years' experience to help them in their metallurgical problems whereas plastics are but a baby and have this leeway to make up. Also the irresponsible plastics manufacturers of the immediate post-war years who gave the industry a bad name, must be eliminated if the motor and plastics industries are to derive mutual advantage from each other.

Despite the work already done and the information available, we are only scratching the surface of what is required to enable us in the motor industry to use to the full the achievements of the polymer chemists.

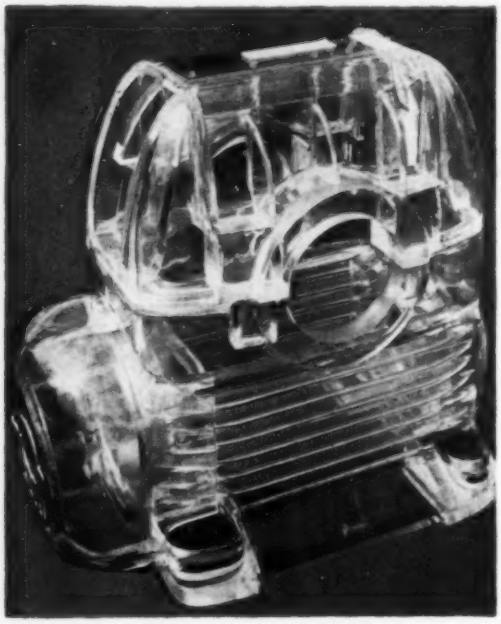
The evaluation of new and older polymers must be a priority and testing techniques greatly improved and quickened if the motor and plastics industries are to continue their present rapid progress.

To achieve this demands closer liaison and a detailed knowledge of the motor industry's requirements to which it is hoped, this article has been an introduction.

Heavy Publicity

Stockists of floor coverings in London and the home counties are being presented with a 'complete sales kit' — a folder weighing over 4lb. It contains 17 items which cover the intensive autumn promotional campaign for MarleyFlor Consort (sheet vinyl material).

The sales office of Laporte Titanium Ltd. is now at New Bond Street House, 1-5 New Bond Street, London, W.1, instead of at Hanover House. The new telephone number is HYDe Park 0631-7. Laporte Group advertising and publicity will also be dealt with at New Bond Street House, instead of at Fetter Lane.



Gearbox case in Perspex to show operation of gears, made by Precision Products (Leeds) Ltd.

Engineering in Thermoplastics

By T. S. KIRKBY

ENGINEERING has always been associated with metal in its many forms and applications, and in the working of metal, machines are used which remove, bend, twist, stretch, push, pull, press, stamp and otherwise ill-treat it. If you substitute a thermoplastic material for metal, make minor alterations to the machines, and add a little 'know how' the result will be a profusion of products as varied in their application as any ever produced in metal. As a craftsman the engineer is usually associated with a particular branch of his trade, mechanical, electrical, civil, motor, mining, chemical, etc., and to this list can now be added the plastics engineer.

This new breed of men are invariably traditional engineers who have changed over entirely from the working of metal to plastics and it is with these craftsmen this article is concerned.

As a full-time job the plastics engineer is a composite of all the other branches. He has to be able to meet a demand that varies from a part for a machine down a mine or in an aircraft, in a textile mill or a brewery, for a cheese making machine or a piece of delicate apparatus for a surgeon. Men of all other trades expect immediate answers to their problems, which means that the plastics man must have a pretty sound knowledge of every other man's job, and an even wider knowledge of the ever growing variety of materials available. He must have at his finger tips the physical, mechanical, thermal and chemical properties of every one of these materials including any new one that was probably only announced to the trade and mentioned for the first time in last week's technical press. He must be able to advise his customer which material will be best, and probably have to invent a new way of producing the desired shape, often with no precedent to guide him.

Naturally the customer wants to know the cost first, and as he probably only wants a 'one off,' and as it is anybody's guess how many will be made experimentally before an acceptable unit is produced, estimating can be a ticklish job.

Specialist Firms

This need to cope with a vast amount of specialization has already led to this new industry breaking up into specialist firms, each concentrating on only a few materials of similar characteristics, or on products of kindred types. Not only is their knowledge and 'know how' specialized, but so is their machinery, and probably just as important, so are their workmen. This is obviously to the benefit of the customer as over the past few years there has come into being a number of firms on whom industry of all kinds can call for guidance and assistance. These firms are not necessarily large organizations, many being of no more than 20 employees, but all of them, large and small, have one common factor. Whatever they may have been before they came to working in plastics they are now in an industry which, more than any other, lives to serve the customer. This spirit of service is further supported to the customers' benefit, by another facet which seems to pervade the industry. It is that all these men appear to have a perpetually inquiring mind. They are forever seeking out new ways of doing things, or experimenting with a new material, or testing an old material in a new shape or new application.

THE AUTHOR

T. S. KIRKBY spent the first 10 years of his working life in the motor trade. He became a member of the Institute of the Motor Industry in 1937, following this by a period of training in production engineering. Throughout the war he was with the Ministry of Supply as an executive technician on armoured fighting vehicle production. In 1946 he started his own business, Precision Products (Leeds) Ltd. This has expanded over the past 14 years, and now produces almost anything that can be made from the thermoplastic range of sheet, tube, and block. Mr Kirkby is chairman of the Yorkshire Section of the Plastics Institute, a member of the Institute since 1947, and has been on the Section Committee for the maximum permissable period.

Sometimes the need for a unit never previously made will trigger off a series of tests and experiments with an existing material which results in the designing and building of a new machine. The new machine in turn opens out a new field with potentialities for a different material and thus

Corrosive fume removal fan made from I.C.I. Darvic PVC by Keith Blackman Ltd. Unsupported PVC on inlet and outlet made by Rubber Improvement Ltd., from I.C.I. Corvic

creates a demand for a new material. And so on in a never ending spiral of mechanical ingenuity keeping pace with demand, and the demand for ever calling for more ingenious mechanical devices. The vacuum moulding field is a perfect example of this sequence of events.

The scope and variety of parts that are produced by these engineers is so great that they are impossible to enumerate but a brief review of the methods and the machinery may prove surprising to those readers who are not connected with this branch of the plastics industry.

The materials are all of the thermoplastic group, except in the case of the laminates, which are based on various resins. 'Perspex' is, of course, one of the best known of them all, and is probably the one that first attracted the engineer as a medium for either replacing his traditional metal, or for making something that was not possible in metal.

It is used in all its forms, sheet, rod, tube, and block, and the recent introduction of very large and very thick blocks, up to 6in. thick, has opened up an entirely new field of applications.

PVC is also used in sheet, rod, tube and block, and in addition is available in a variety of types and grades, each of a composition that gives the material qualities suitable for different methods of working and widely different applications.

Polythene similarly is available in the four basic forms, but it differs slightly from the previous two in the methods of working it and handling it. Polystyrene is not so much used in the machine shop in block form, but has many applications in its sheet form. Nylon conversely is much more popular in thick lumps, bars and rods, and less so in sheet. This very versatile material is also available in different grades, but as they can all be worked in similar ways in the machine shop, the choice is dependent on the end use rather than on the method of production.

The phenolic laminates such as 'Tufnol' and 'Bakelite' have excellent machining qualities, and are all used in sheet, tube, rod and block.

The methods of working and machinery used are quite normal at first glance, and vary only in detail from tradition. But this 'variation in detail' is so important that it is often knowledge which is jealously guarded. Of the engineers' tools, lathes and milling machines of all kinds are the most used, turning, boring, threading, slotting and generally shaping all of the previously mentioned materials. Speeds and rates of cut and tool angles will vary from works to works, as will the jigs used and the methods of holding the material in the machine. Many of the articles produced are required only in small numbers and mass production machinery is not often called for, but when it is these are easily adapted to working on plastics.

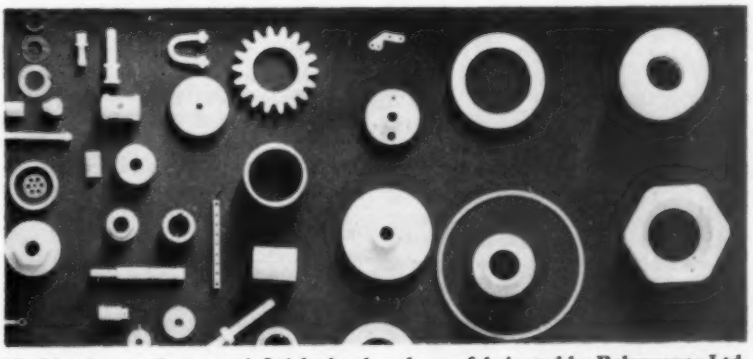
Many machines from the woodworking trades are in every day use such as the circular saw, band saw, router, spindle moulder, and a variety of linishers. When an engineer starts using machines from other trades there are liable to be some peculiar results, and there are some very ingenious adaptations to be seen in the works.

The circular saw is not only the first machine to which the plastic material is introduced, but by the use of different blades, stops, guide rails, sliding and rotating work holders, it is made to do work that its maker never dreamt of. It has become a machine capable of a fine degree of accuracy and can produce simple or complex shapes either singly or in accurate repetition.

The band saw has been similarly adapted, but not to quite the same extent. The jig saw, particularly the type in which the blade is fixed at one end only, is made to do a great deal of work.

The router in its various forms has been adapted, altered and added to and been brought into every day use simply because it is such a versatile machine. It has the ability to remove large amounts of material quickly, and at the same time to produce a fine quality finish. In the hands of an expert it will work to very close limits. Sometimes the work piece moves round the cutter and sometimes the work is fixed and the cutter is moved, producing intricate patterns.

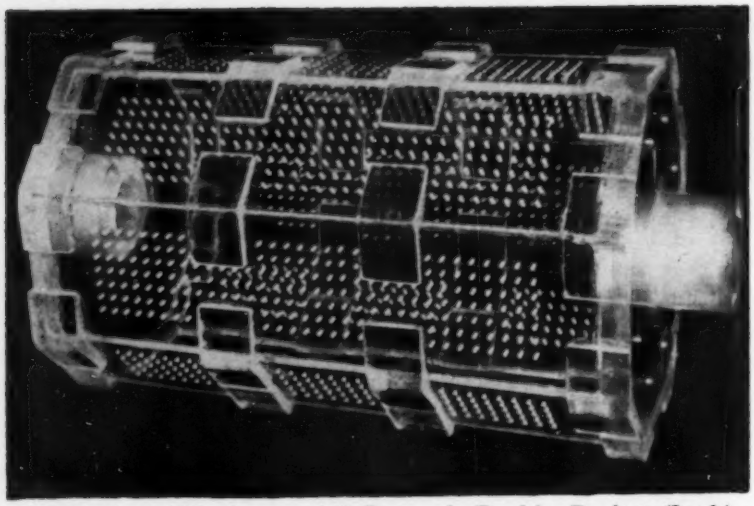
Edging, straight line work, slotting, rebating, etc., is the job of the spindle moulder, a machine which did not require much adaptation apart from changes to the tool and cutting edges. Of the many makes of linisher in use the large diameter disc is probably the most versatile. A variety of fixtures can be added to make an accurate repetition-work machine.



Machined parts from semi-finished nylon shapes fabricated by Polyprenco Ltd.

Drills, flexible drives and all hand tools are 'maids of all work.' High speed burrs, rotary files, weird shaped cutters, peculiarly ground end mills and spot face cutters, and similar engineers' tools are used to achieve a mixture of results, from high speed material removal to high quality finishes.

Sprinkled around the industry are a number of craftsmen who are part engineer, part sculptor. These men will cut and carve, scrape and file,



Tumbler barrel 36in. long, made in Perspex by Precision Products (Leeds) Ltd.

using the hand tools to produce shapes that no machine could make. Usually they are making a 'one off' but occasionally a short run of two or three dozen may be hand produced and although this is an expensive way it can be cheaper than production requiring intricate moulds.

Hot Work

But of all the ways in which the plastic engineer treats, or ill treats, his materials it is the things he does to it when it is hot that show the most ingenuity. All the thermoplastics, but particularly 'Perspex' PVC and polystyrene can be formed into almost any shape when hot, and the machinery to do this must vary from shop to shop more than any of the others. What the engineer used to do to sheet metal he can do to thermoplastic sheet, but his method will rarely bear any similarity to the ways in which he used to form metal.

Using air, at high pressure and in vacuum, hydraulics, screw presses, hand clamps and often quite simply some heavy weights, a sheet of material can be persuaded to take the most unlikely shape. It is in this part of the works that there are some of the most closely guarded secrets. Where one firm achieves the desired result in one way, another may adopt an entirely different method, and only an expert could detect any difference in the finished article.

The single curvature shape which looks so simple often presents problems due to the manner in which the thermoplastic material shrinks when cooling. Long but narrow units with large radius bends have a bad habit of bowing in the reverse direction when removed from the mould. This leads to some very queer looking moulds and clamping methods, often the result of trial and error coupled with previous experience. Quite often the need to keep down the cost of only a few articles results in a mould of which Mr Heath Robinson would have been proud. But when the order is for a long run, then semi-automation and well designed moulds, coupled with air operation presses or other clamping mediums, and carefully timed cooling and heating cycles can save a lot of time per unit, and also accurately reproduce a shape.

Shapes Complex and Simple

Shapes of a more complex nature such as boxes, trays, dishes, and generally any unit with faces or curves in more than one plane, are often less troublesome to the mould and tool designer than the more simple single curves. Production of these three dimensional units may call for a simple cavity mould into which the hot material can be pushed by air pressure, or sucked by vacuum. It may need a plug and cavity tool with no other assistance, but often all these methods may be amalgamated. The possible combinations of air pressure, vacuum and plug, and the sequence in which they will be operated are usually determined by the 'stretchability' of the material, and the need to avoid thinning-out in the wrong places. The machines which have been built to incorporate all these possible variations are typical of the manner in which the engineer has turned his hand and ingenuity to the working of plastics. Whilst there are several such machines complete in every detail available on the market, there are many that have been built in their own works by the specialist firm.

It is on these home built machines that many of the short run orders are made, and in which initial mould costs are kept down to a minimum. Such machines lend themselves to quick setting up of the mould, reasonably short time cycles per unit, and accurate reproduction of the desired shape.

The moulds themselves are worthy of mention. They can be a simple piece of hard wood, plaster of paris, cement, casting resins, glass fibre, phenolic laminates, sheet metal, metal bars and angle, cast aluminium or a combination of two or more of these. It is in the mould that the engineers' craftsmanship and his 'know how' are combined to achieve the desired result, and it is here again that his method and his tools are his own secrets. Although it is true to say that two firms in no way connected with one another will quite often produce similar units in almost identical moulds it is also true that they can produce similar units in quite different ways, the field is so wide and the methods so flexible.

Scope for Invention

All shapes made in this manner have then to be cut-out, have the clamping area removed or be otherwise machined, and here again the machinery comes into its own. Lathes, milling machines, routers, saws, etc., are used in every conceivable way, and the jigging and tooling allows plenty of scope for the man with an inventive turn of mind.

And what, you may ask, does all this produce. And the answer is practically anything. From a simple machine guard to a complete gear box; from a chemical vat to the stopcock that feeds it; from a lighting fitting to the control panel in the power house; from a delicate piece of laboratory equipment to the replacement of a broken bone, and so on. There is no trade, no workshop, no factory that at some time or other does not want something from the plastics engineer. And it is very rare indeed that they do not get it, although sometimes they appear to be trying very hard to ask for the impossible, which naturally, takes a day or two longer.

The Michelin SDS 5.20-13 tyre with tube is standard original equipment on the new GSM Delta Sports and GT cars. Optional original equipment is 'X' tyres or SDS whitewall tyres. The SDS can be driven at sustained speed up to 105 mph.

The Norwegian Plastics Industry

This, and the following article on Denmark will be followed in future issues of *RJIP* by articles on the plastics industries of other EFTA countries.

WITH its 3.5m. inhabitants Norway is the most sparsely populated of the EFTA countries. It has, nevertheless, a very developed commercial life, based principally on the raw materials from the forests and fisheries and on the supply of sufficient quantities of electric power.

The standard of living is high as in the other Scandinavian countries and some of the other EFTA countries like for instance Switzerland and the UK. This high standard of living has, among other things, made itself manifest through the great demand for plastics. Below is given a table showing the *per capita* consumption of plastics in the different EFTA countries.

Table 1
Per capita Consumption of Plastics (kg.) 1958

Austria	4.4
Denmark	6.5
Norway*	7.4
Portugal	1.1
Sweden	8.7
Switzerland	n.a.
UK	6.4

* For Norway the figure for 1959 has been used as the report for 1958 was not correct.

As will be seen from the figures, Sweden has the highest *per capita* consumption. Norway, UK, and Denmark are almost at an equal level. A high *per capita* consumption of plastics, however, does not mean that the total consumption is very high from a European point of view. The total consumption was thus in 1959 approx. 26,000 tons, whereas the corresponding figure for UK was approx. 400,000 tons.

A very considerable part of the domestic consumption of plastics is covered by imports, in all between 60 and 70%. The balance is covered by the country's own production, of which about 40% is consumed on the domestic market.

Production

A market of only 3.5m. inhabitants is, of course, not big enough by itself to form the basis for production of plastics on a large scale. It must in any case be clear that so small a market will have a limiting effect on the number of types which can be produced economically. In spite of this drawback as to the size of the market, the Norwegian plastics industry has been growing steadily, and is today quite important. It must be added that it is perhaps not as varied as it would have been, if the domestic market had made possible a better exploitation of the existing raw materials.

The development of the Norwegian production of plastics in the period 1954-1959 is shown in Table 2. As will be seen, the volume of production has been quadrupled or quintupled in the course of a five years period. For the years 1957-1958, at the moment the latest years for which comparable data can be obtained, Norway was the OEEC country with the highest relative increase in the production of plastics.

Regarding the types of plastic of which the production is composed, the raw materials at hand are of the greatest importance. Norway has an abudant supply of cheap electric power, a relatively good forest resources and a highly developed wood processing industry. On the other hand we have no coal and no oil, and with the important position the petro-industries have been gaining in the plastics production of the world, it is evident that we have not been able to follow the development which has taken place in this line. Nevertheless, at the moment oil refineries are being erected and there is every reason to believe that we shall develop plastics based on oil.

Table 2
Output of Plastics in Norway

Year	Metric tons
1954	5,078
1955	7,207
1956	9,366
1957	14,526
1958	19,645
1959	22,632

The bulk of the Norwegian plastics production has been in the thermosetting line, first of all amino-plastics (produced by Norsk Sprængstofindustri A/S). Next to Sweden, Norway has the highest *per capita* consumption of paints and varnish in Europe, partly due to its big commercial fleet and partly due to the great and important role wood plays as material for the building of residential houses. This has brought about a relatively big production of alkyds by De-No-Fa, Norsk Sprængstofindustri A/S and some of the greatest manufacturers of paints and varnish. The production of alkyds in 1959 was a little below 5,000 tons. De-No-Fa also produces polyester resins.

We have, however, little by little, achieved production of PVC, the total production in 1959 was 5,000 tons; in 1955 it was 1,760 tons. The manufacturer is Norsk Hydro-Elektrisk Kvælstof A/S, which produces its own carbide (and urea), and there is every reason to believe that the production of PVC can be further increased in the future. PVA is being produced by the wood processing concern Aktieselskapet Borregaard using its own raw materials. The capacity of this plant is calculated to be approx. 3,000 tons, but the production is at the moment considerably smaller. As already mentioned, Norway has no oil refineries and consequently there is no production of such important plastics as polythene and polystyrene.

The development in the production for the period 1955-1958 for the most important types of plastics is shown in Table 3. As will be seen, the production of amino-plastics is increasing considerably, the production has tripled in the period in question and constitutes at the moment approx. 50% of the country's total production of plastics. The production of PVC has also increased considerably.

Table 3
Production of Chief Plastics in Norway (Metric tons)

	Phelonic and cresylic	U.f. resins	PVC	All types
1958	1,000	9,550	4,233	19,645
1957	730	6,670	2,300	14,526
1956	900	3,085	2,300	9,687
1955	749	3,241	1,760	9,004

The strong position of the thermosetting materials is clearly seen from Table 3a, where the production of plastics of some other countries has

Table 3a
Distribution of Types of Material Production, 1958 (%)

	Thermo-setting	Thermo-plastics (except cellulosics)	Cellu-losics
Norway	77.3	21.7	1.0
Sweden	59.2	25.6	15.2
UK	38.1	49.2	12.7
Germany	42.4	46.8	10.8
USA	32.2	64.4	3.4

also been taken into account, separated into the principal groups. It appears that 77.3% of the total production of plastics in Norway is of the thermosetting types, while the corresponding percentage for the UK is 38.2%. There is reason to believe that we in Norway in the years to come will see a change in the composition of the production, as the production of PVC as well as PVA will most likely increase. Further there is believed to be under development a local production of cellulose acetate.

Finished Articles

The obtainable statistics regarding the production of finished articles are unfortunately not as complete as could be desired. They are shown in Table 4.

Table 4
Production of Finished Plastic Goods in Norway

Year	Number of firms*	Production value (Mill. kr.)
1949	15	8.6
1950	18	13.0
1952	26	15.8
1953	29	21.4
1954	34	34.9
1955	46	51.1
1957	59	75.5
1958	57	76.7†

* Includes only firms with six or more employees.

† All manufacture of finished products exceeded 100 million kr.

Altogether the factories producing finished goods in Norway are small, those contained in the official statistics have an average of 25 employees.

The variety of articles produced is, however, considerable and covers the majority of the consumption. The import of finished articles of plastics is about 15% of the total consumption.

Import

As already mentioned above the domestic production of plastics in Norway covers only part of the requirements of the country. Norway has therefore a considerable import of raw materials as well as finished articles. Below in Table 5 is indicated the imports in 1959 classified into different groups following the Brussels nomenclature. The total import is, as will be seen, nearly 17,000 tons to a value of approx. 105m. Norwegian Crowns. The most important groups are 39.01, 39.02, 39.03 and 39.07. The preponderant group is undoubtedly 39.02 with approx. 60% of the total import. The import of polythene is by far the most important item and is steadily increasing being in 1959 4,293 tons. Also great quantities of PVC, approx. 2,000 tons, and polystyrene, approx. 1,500 tons, are imported. In the thermosetting group the dominant products are alkyds (mostly specialities), phenolic resins, amino moulding powders and polyesters.

Table 5
Imports of Plastics* into Norway in 1959

Class	Total Metric tons	Total Value (1,000 kr.)
Thermosetting: 39.01	3,053	15,523
Thermoplastic: 39.02	10,859	58,478
Cellulosics: 39.03 ..	1,407	13,849
Casein: 39.04 ..	30	920
Modified natural resins: 39.05 ..	422	2,018
Other polymers:† 39.06	570	2,018
Finished products from materials of 39.01-06: 39.07 ..	596	12,427
	16,937	105,233

* As defined by Chapter 39 of Brussels Nomenclature.

† Mostly alginates.

Of the combined imports approx. 42% is from EFTA countries, a somewhat smaller part being imported from the countries of the Common Market. Approx. 20% of the value of the imported goods come from countries outside the two big trade groups, the principal part of which is polythene, whereof approx. 50% of the country's consumption is covered through import from the USA. Of interest is the import from UK in 1959 as shown in Table 6.

In the group 39.01 Great Britain holds the strongest position with an import of approx. 675 tons or 20-25% of the total. Great Britain's part under 39.02 is quantatively somewhat over one third. The most important raw materials being purchased from Great Britain are polythene, PVC and polystyrene.

Further the part of group 39.04 is approx. 25%. Concerning the group 39.07, finished goods, it must be said that the position of Great Britain is remarkably weak. Of a total import of 596 tons, only 40 tons come from Great Britain, a quantity which is only one third of Sweden's export of finished articles to Norway. It seems reasonable that there should be possibilities of increasing the import from Great Britain to Norway under this group.

Export

As already mentioned the small Norwegian domestic market permits only a limited production of plastics. The fact that it has been possible to establish an export, has made the great increase in the production of plastics in Norway during the last five years feasible. In the same way as the production, the export has also increased considerably, being in 1959 14,000 tons, which is 60% of the total production (Table 6). The most important group is amino-plastics, being somewhat more than 60% of the total export. About 30% come under group 39.02, the greater part of this being PVC.

Table 6
Exports of Plastics* from Norway in 1959

Class	Total Metric tons	Total Value (1,000 kr.)
Thermosetting: 39.01	8,502	15,158
Thermoplastic: 39.02	4,176	10,966
Cellulosics: 39.03 ..	45	215
Casein: 39.04 ..	28	228
Modified natural resins: 39.05 ..	13	44
Other polymers:† 39.06	479	5,592
Finished products from materials of 39.01-06: 39.07 ..	569	6,421
	13,812	38,624

* As defined by Chapter 39 of Brussels Nomenclature.

† Mostly alginates.

Generally it can be said that the variety of exported plastics is much more limited than the import, which is a result of the unusual composition of the country's production of plastics.

On the other hand the export shows a decided geographical variation. The export to the EFTA and EEC countries is respectively 22 and 11% of the total export, which means that two thirds of the total export goes to countries outside the two big trade groups.

Looking once again at the mutual trade between Norway and Great Britain (Table 7), we find that 12%

Table 7
Norwegian Exports of Plastics to UK

	Metric tons	Value (1,000 kr.)
39.01	12.6	41
39.02	1,567.0	4,188
39.03	0.7	5
39.04	—	—
39.05	—	—
39.06	39.4	444
39.07	41.0	553
Total	1,660.7	5,231

of the total volume of export of plastics from Norway goes to the UK. The preponderant export is under group 39.02, mainly PVC. It is reasonable to believe that the forming of the new markets, which is now a reality, should lead to an increase of the Norwegian export of plastics to Great Britain.

Plastics Industry in Denmark

EXPANDING MARKET FOR RAW MATERIALS AND MACHINERY

DENMARK as an industrial country is not very old. For this reason you will find but a limited number of machine manufacturers and chemical industries compared to many other countries of the same cultural and economical level. Thus it will be easy to understand why Denmark has so relatively few manufacturers of plastics raw materials and machinery whilst on the other hand modern times and recent industrialism have created quite a number of able manufacturers of finished products. Increasing demands for semi-finished goods in conjunction with the realization of the EFTA market plans will, however, in time change this line of development so that in future Denmark will take her place in the international community as an integrating part of the total production and markets within all branches of this industry. As an example, the recently formed company, DanBritChem A/S should be mentioned. Partners in the company are the Danish Maersk Refinery and Imperial Chemical Industries, and production of polythene, 15,000 tons a year, will commence in 18 months.

Other reasons for the absence of basic industries have been the unfavourable terms in the previous customs legislation. Thus the Dansk Polystyrol Fabrik A/S had to discontinue the production of polystyrene after five years, and Polyplex A/S and Arbolit A/S have stopped their production of phenol-formaldehyde moulding powders, irrespective of their ability to compete on quality with the imported products.

The development in the machine business has been more promising as Denmark has always had a good reputation for the level of her craftsmanship. Consequently you will find internationally appreciated plastics machinery such as presses, injection moulding machines, extruders, bottle machines, hydraulic and electric equipment, heat sealing machines, pumps, thermal control accessories, tools, etc., all of Danish manufacture.

Market for Raw Materials Imports

The consumption of raw materials is proportionally the same as in other European countries although it must be mentioned that a fair amount of the production of finished goods are exported. Generally stated the industry consists of 300 smaller or bigger companies with an annual consumption of D.Kr.150m. (£7½m.) and a corresponding production value of D.Kr.300m. finished goods of which approximately 30% are exported.

Some important resins are used in the following amounts:

	Tons
Polythene and ethylene co-polymers	5-6,000
PVC and other vinyl polymers	6-7,000
Polystyrene and styrene co-polymers	2-3,000
Polyamides	500-1,000
Unsaturated polyesters ..	500-1,000
Acrylics	3-500

although it must be emphasized that the above figures build on an estimation.

Inland production of raw materials comprises phenol-formaldehyde moulding powders, alkyds, urea-formaldehyde adhesives, unsaturated polyesters, plasticizers, acrylic sheets and cellulose acetate film.

Market for Machinery Imports

As already stated, Denmark has a fair production of machinery to the plastics industry but in view of the variety of machinery required it is far from sufficient. This applies to types as well as to sizes, and very few import figures are really affected by the inland production already mentioned, the less so because a fair part of the Danish machinery is exported.

Thus Denmark is really an international free market for all types of plastics machinery, and the trends in the demand are the same as in other industrialized countries: bigger machines, faster machines, more specialized machines.

A rough estimate will show that 40% of the production machines are injection moulding machines, 25% extruders, 15% presses and the rest calenders, spreading equipment, dipping, slush moulding and miscellaneous machinery. It must be pointed out, however, that these figures comprise all sizes and models, and they will never be equally important, neither to the manufacturer himself, nor to the suppliers of raw materials and machinery. Some of the machines are specialized as cable machines, film and bottle blowing equipment, closure presses, tube and sheet plants, etc., too.

Recent developments in the plastic industries all over the world have shown that the 'old' companies have invaded the plastics industry to an increasing extent. This will mean more capital, especially more liquid capital, and more planning than before, and these circumstances inevitably will leave their marks on future dispositions regarding plastics machinery.

Market for Finished Products Imports

In the production of finished goods Denmark is restrained by her size only. This means that prices of imported products should be highly competitive where the products in question could be classified as common plastics goods, *i.e.*, houseware, packaging articles, sheeting, tubes, electrical articles, etc., the manufacture of which is justified even with a market of 4 million inhabitants only.

Here hard competition between the Danish producers themselves have brought prices low, and consequently productivity has had to improve. As a result Danish finished plastics goods are highly competitive in the export markets even where customs tariffs are relatively high.

For other articles, so-called custom mouldings for special purposes, Denmark will hardly be of any interest to foreign plastics manufacturers as size of orders will be fairly small, and lines of communication too long.

The last group of articles, goods for which the inland production would be too small, is already imported to a great extent. Here you find pipe fittings, artificial leather, big vessels, sanitary equipment, building articles, technical sections, furniture, laminates, toys, fancy goods, photographic articles, etc., all articles where the moulds would never pay, or where the market demands a larger selection than the size of the population justifies.

'Underseal' Registered

The name 'Underseal' has been registered as a protective trade mark for vehicle rubberized under-body protective coating by Minnesota Mining and Manufacturing Co., with effect from June 23 1955.

UK Exports of Rubber Products

PROGRESS OF TRADE DURING RECENT YEARS

Statistics Specially Compiled from Official Sources by the Federation of British Rubber and Allied Manufacturers. A graph showing UK exports of general rubber products other than tyres and tubes in recent years is given on page 645.

(a) General Rubber Goods (excluding Tyres and Tubes)

Group 'A'—RUBBER MANUFACTURES —comprises sheeting, composition soling sheet, rubberized or proofed fabrics, printers' blanket, thread, hose, flooring, ebonite, other rubber-fabricated materials (including tubing), surgical products, gloves, cellular (including latex foam products), adhesives, compounds and solutions, hot water bottles, bands, erasers and various manufactures of rubber and synthetic rubber such as industrials and mechanicals.

Group 'B'—BELTING — comprises balata belting, rubber and rubber reinforced with other materials, conveyor and transmission belting, motor vehicle fan belts and PVC belting. 1959 was the first year in which figures were made available by the Board of Trade for PVC belting.

Group 'C' — FOOTWEAR — comprises industrial boots, Wellingtons, rubber bootees, overshoes and goloshes and rubber-soled canvas footwear, and soles and heels.

Group 'D' — TOYS AND BALLS — comprises golf and tennis balls, other balls for sports and games, balloons and rubber toys, and football and other bladders.

ALL COUNTRIES
(Figures in £ Sterling)

	Year 1957	Year 1958	Year 1959	First 6 mths 1960
Rubber Manufactures (Group 'A')				
Sheets and sheeting	509,802	566,401	556,715	279,380
Rubberized or proofed fabrics	1,685,640	1,587,260	1,625,359	1,596,002
Thread	579,442	496,788	491,691	343,561
Hose	2,219,574	2,442,039	2,421,359	1,433,685
Flooring	273,232	351,482	386,499	215,270
Ebonite, etc.	388,424	298,976	176,288	84,383
Other rubber fabricated materials	77,041	155,451	281,974	130,419
Surgical products	649,712	667,427	727,570	449,902
Hot-water bottles	247,051	213,219	240,098	92,189
Cellular rubber	915,880	800,634	729,026	396,279
Other products	3,169,173	3,764,519	4,047,708	2,355,378
Total	10,714,971	11,344,196	11,684,287	7,376,448
Belting (Group 'B')				
Balata	140,355	147,454	167,533	87,373
Rubber, and reinforced rubber conveyor and transmission	2,880,043	2,658,037	2,798,196	1,669,192
Motor vehicle fan belts	171,909	221,965	186,171	95,312
PVC belting	—	—	362,125	176,531
Total	3,192,307	3,027,456	3,514,025	1,851,877
Footwear (Group 'C')				
Boots and shoes	1,758,887	1,646,483	1,522,775	728,279
Soles and heels	276,924	274,783	246,028	335,064
Total	2,035,811	1,921,266	1,768,803	1,063,343
Toys, Balls, etc. (Group 'D')				
Golf and tennis balls	1,342,763	1,320,282	1,524,744	956,094
Other toys, balls and bladders	223,305	213,005	214,831	115,742
Total	1,566,068	1,533,287	1,739,575	1,071,836

(Figures in £1,000 Sterling)

Group	Year 1957	Year 1958	Year 1959	First 6 mths 1960
AUSTRALIA				
'A'	704.4	763.2	684.7	464.9
'B'	103.5	85.8	86.9	81.6
'C'	20.7	23.9	12.7	15.6
'D'	23.8	41.1	44.4	42.4
AUSTRIA				
'A'	46.8	53.8	54.8	23.8
'B'	7.2	6.4	4.5	5.4
'C'	1.6	117*	78*	73*
'D'	14.2	13.8	18.2	13.2
BELGIUM				
'A'	421.5	319.4	309.1	247.0
'B'	96.8	92.8	135.7	73.3
'C'	44.8	36.3	40.0	12.2
'D'	31.2	28.5	42.2	40.9
BELGIAN CONGO (CONGO REPUBLIC)				
'A'	16.8	11.4	13.1	4.4
'B'	38.9	65.6	36.6	22.1
'C'	9.0	289*	650*	195*
'D'	6.9	6.8	4.7	2.4
BURMA				
'A'	64.2	59.5	76.0	25.0
'B'	71.1	24.1	89.3	26.2
'C'	8.1	8.8	13.7	5.2
'D'	10.8	16.7	20.6	12.7

Group	Year 1957	Year 1958	Year 1959	First 6 mths 1960
CANADA				
'A'	398.2	474.8	515.2	341.4
'B'	154.9	237.3	230.1	127.9
'C'	239.6	261.2	324.2	168.5
'D'	149.9	135.0	134.1	95.8
CEYLON				
'A'	75.9	72.9	71.3	64.2
'B'	17.1	19.8	25.5	15.7
'C'	2.2	3.0	4.0	2.0
'D'	5.2	5.9	3.6	1.3
CHILE				
'A'	45.9	36.5	41.5	39.5
'B'	86.4	127.8	113.2	77.7
'C'	2.5	4.3	4.7	3.0
'D'	7.8	4.7	3.1	4.7
CUBA				
'A'	37.1	36.5	18.4	4.3
'B'	4.3	10.1	3.8	925*
'C'	14.6	13.8	10.7	1.2
'D'	13.5	12.3	8.6	5.6

**Actual figures not £1,000*

UK Export of Rubber Products

(Figures in £1,000 Sterling)

Group	Year 1957	Year 1958	Year 1959	First 6 mths 1960
CYPRUS				
'A'	57.1	40.2	47.5	17.0
'B'	14.8	12.4	9.4	6.4
'C'	54.9	21.2	38.8	8.7
'D'	4.0	4.6	3.3	1.1
DENMARK				
'A'	265.5	274.9	319.8	204.0
'B'	16.1	21.1	21.3	10.8
'C'	11.2	9.2	12.3	4.1
'D'	10.7	10.5	12.6	8.3
UNITED ARAB REPUBLIC (EGYPT AND SYRIA)				
'A'	(2.1†)	37.1	63.4	43.1
'B'	(471*)	14.6	8.3	7.3
'C'	(210*)	1.8	1.9	588*
'D'	(457*)	5.4	5.9	548*
FINLAND				
'A'	145.9	231.3	247.6	150.4
'B'	5.2	30.6	18.6	15.5
'C'	—	1.3	609*	172*
'D'	735*	788*	2.1	3.8
FRANCE				
'A'	260.6	225.2	209.8	216.1
'B'	45.8	33.0	37.1	34.3
'C'	4.0	6.5	4.5	2.7
'D'	46.2	40.8	40.0	26.6
GERMANY (WESTERN)				
'A'	220.7	417.7	538.1	298.4
'B'	1.0	10.0	5.0	6.4
'C'	10.7	19.8	31.4	22.6
'D'	62.3	58.8	70.5	62.6
GHANA				
'A'	182.4	214.6	197.6	120.4
'B'	34.9	52.4	49.8	44.9
'C'	29.3	25.9	21.3	21.0
'D'	3.7	4.4	6.2	2.7
GREECE				
'A'	41.7	39.6	60.8	26.1
'B'	8.4	13.4	13.8	5.4
'C'	823*	477*	582*	582*
'D'	1.5	2.1	1.7	771*
HONG KONG				
'A'	153.1	152.8	114.2	88.8
'B'	17.5	14.5	14.6	8.6
'C'	10.3	9.8	14.0	10.4
'D'	56.6	59.4	60.7	53.7
ICELAND				
'A'	47.5	40.3	34.8	16.1
'B'	7.0	8.5	8.2	3.5
'C'	1.2	2.7	1.9	3.1
'D'	281*	240*	107*	37*
INDIA				
'A'	173.7	155.6	160.1	114.7
'B'	365.5	124.8	151.1	201.9
'C'	1.0	703*	3.8	3.9
'D'	34.1	15.0	7.3	3.8
INDONESIA				
'A'	49.2	50.7	42.8	19.0
'B'	22.7	15.5	44.1	6.7
'C'	3.4	886*	1.3	261*
'D'	81.0	15.3	64.8	10.2
IRAN				
'A'	176.8	147.7	439.7	92.3
'B'	25.9	17.1	22.3	13.3
'C'	21.5	46.7	10.3	6.1
'D'	3.3	3.4	5.7	4.6

†*Figures in parenthesis are for Egypt only*

Group	Year 1957	Year 1958	Year 1959	First 6 mths 1960
IRAQ				
'A'	94.7	84.4	79.2	56.7
'B'	25.0	21.8	22.0	10.3
'C'	12.7	8.8	10.6	4.1
'D'	4.5	4.4	1.4	2.2
IRISH REPUBLIC				
'A'	641.4	732.5	771.8	440.1
'B'	79.6	87.2	89.4	49.5
'C'	68.7	79.4	67.7	132.0
'D'	13.2	18.5	19.1	7.6
ITALY				
'A'	420.4	498.4	520.4	412.7
'B'	18.6	59.0	36.4	16.9
'C'	3.9	3.9	3.7	2.8
'D'	22.4	26.0	29.9	22.3
JAMAICA				
'A'	100.2	118.7	90.2	62.2
'B'	17.7	38.5	36.6	22.2
'C'	158.0	135.6	132.6	58.3
'D'	8.7	9.4	14.9	8.0
KENYA, TANGANYIKA-UGANDA				
'A'	125.1	144.0	131.1	76.3
'B'	55.5	57.9	77.9	45.8
'C'	83.0	70.7	76.2	44.3
'D'	8.7	7.2	7.4	4.0
KUWAIT				
'A'	130.3	179.3	75.7	34.0
'B'	6.7	8.8	6.1	1.7
'C'	1.9	2.4	14.0	3.0
'D'	1.2	1.8	870*	520*
LEBANON				
'A'	(69.4)‡	39.1	90.2	56.0
'B'	(7.4)	4.2	4.5	2.0
'C'	(10.8)	7.2	8.6	3.4
'D'	(6.1)	5.2	2.9	1.6
MALAYA AND SINGAPORE				
'A'	274.8	228.6	219.6	125.1
'B'	100.2	61.0	62.2	47.9
'C'	43.6	65.5	27.0	12.9
'D'	35.1	53.2	28.8	20.6
MALTA AND GOZO				
'A'	48.7	47.4	49.0	38.2
'B'	2.7	20.6	3.7	1.3
'C'	6.8	8.0	7.7	3.5
'D'	2.6	2.2	2.7	1.0
NETHERLANDS				
'A'	654.6	556.9	552.8	426.3
'B'	78.4	90.0	119.2	64.6
'C'	5.6	5.6	5.8	3.9
'D'	41.5	41.5	47.0	39.1
NETHERLANDS ANTILLES				
'A'	41.9	35.3	34.5	12.1
'B'	1.8	2.7	279*	272*
'C'	5.8	3.8	6.1	1.5
'D'	2.5	3.2	2.4	1.5
NEW ZEALAND				
'A'	648.9	638.9	468.9	385.4
'B'	170.8	239.7	198.5	94.3
'C'	68.0	53.5	21.4	29.4
'D'	99.5	96.6	85.1	62.8
NIGERIA				
'A'	179.4	221.0	214.5	124.4
'B'	23.3	27.1	20.7	21.6
'C'	108.9	214.9	130.2	81.4
'D'	9.8	8.9	24.2	8.2

‡*Figures in parenthesis are for Lebanon and Syria combined*

**Actual figures not* £1,000

UK Export of Rubber Products

(Figures in £1,000 Sterling)

Group	Year 1957	Year 1958	Year 1959	First 6 mths 1960
NORWAY				
'A'	290.3	314.7	317.1	195.8
'B'	10.6	10.1	23.9	7.8
'C'	3.6	10.1	4.5	14.6
'D'	3.7	3.2	4.9	3.4
PAKISTAN				
'A'	123.2	78.0	85.0	90.4
'B'	41.8	56.8	42.4	18.6
'C'	1.0	—	1.1	5.8
'D'	5.3	9.3	12.0	4.2
PERU				
'A'	74.8	61.0	43.1	39.8
'B'	36.0	28.4	61.6	27.4
'C'	2.3	1.6	1.9	3.6
'D'	4.2	5.0	5.8	1.9
PORTUGAL				
'A'	73.8	73.3	71.0	39.6
'B'	30.4	30.0	37.1	10 9
'C'	24.4	29.1	21.6	9 5
'D'	2.4	3.5	2.7	2 2
FEDERATION OF RHODESIA AND NYASALAND				
'A'	112.0	100.8	102.4	62.4
'B'	86.1	194.4	98.5	57.9
'C'	114.6	66.4	70.4	30.9
'D'	23.6	22.4	27.7	9.9
SAUDI ARABIA AND JORDAN				
'A'	45.6	68.5	54.4	34.5
'B'	5.7	7.1	5.1	3.5
'C'	33.7	16.8	5.0	2.8
'D'	1.5	3.2	4.2	1.5
SIERRA LEONE				
'A'	22.7	25.8	19.8	15.0
'B'	31.5	35.1	30.4	2.4
'C'	26.4	20.2	11.8	7.2
'D'	1.6	1.8	1.0	639*
SWEDEN				
'A'	653.3	672.5	611.9	404.8
'B'	41.3	55.2	36.9	20.4
'C'	13.8	12.6	7.8	16.6
'D'	39.2	44.1	34.5	30.4
SWITZERLAND				
'A'	195.6	220.4	280.6	117.7
'B'	65.6	56.0	47.4	21.6
'C'	3.9	5.8	6.0	5.3
'D'	31.3	31.5	38.1	27.1
THAILAND				
'A'	68.8	59.4	68.7	33.4
'B'	25.9	25.3	20.1	16.8
'C'	332*	664*	1.0	371*
'D'	10.0	11.3	13.7	5.9
TRINIDAD AND TOBAGO				
'A'	109.8	113.3	134.4	67.7
'B'	11.1	11.9	14.8	5.7
'C'	123.2	123.2	105.9	59.6
'D'	9.2	9.2	9.9	4.9
TURKEY				
'A'	34.5	18.6	31.3	28.2
'B'	8.6	36.3	37.2	29.9
'C'	1.3	135*	482*	90*
'D'	522*	1.8	2.6	1.6
UNION OF SOUTH AFRICA				
'A'	587.3	656.0	501.9	328.1
'B'	266.3	348.6	271.2	158.0
'C'	13.9	11.6	15.8	29.8
'D'	100.2	100.3	112.5	46.2
USA				
'A'	312.2	391.2	702.9	408.6
'B'	27.0	25.7	68.7	80.3
'C'	231.3	183.1	216.3	87.1
'D'	221.8	224.9	323.2	185.0
VENEZUELA				
'A'	222.2	174.9	178.9	75.3
'B'	55.2	31.1	41.6	16.1
'C'	13.0	19.6	16.6	4.6
'D'	31.3	33.8	43.1	17.1

* *Actual figures not* £1,000

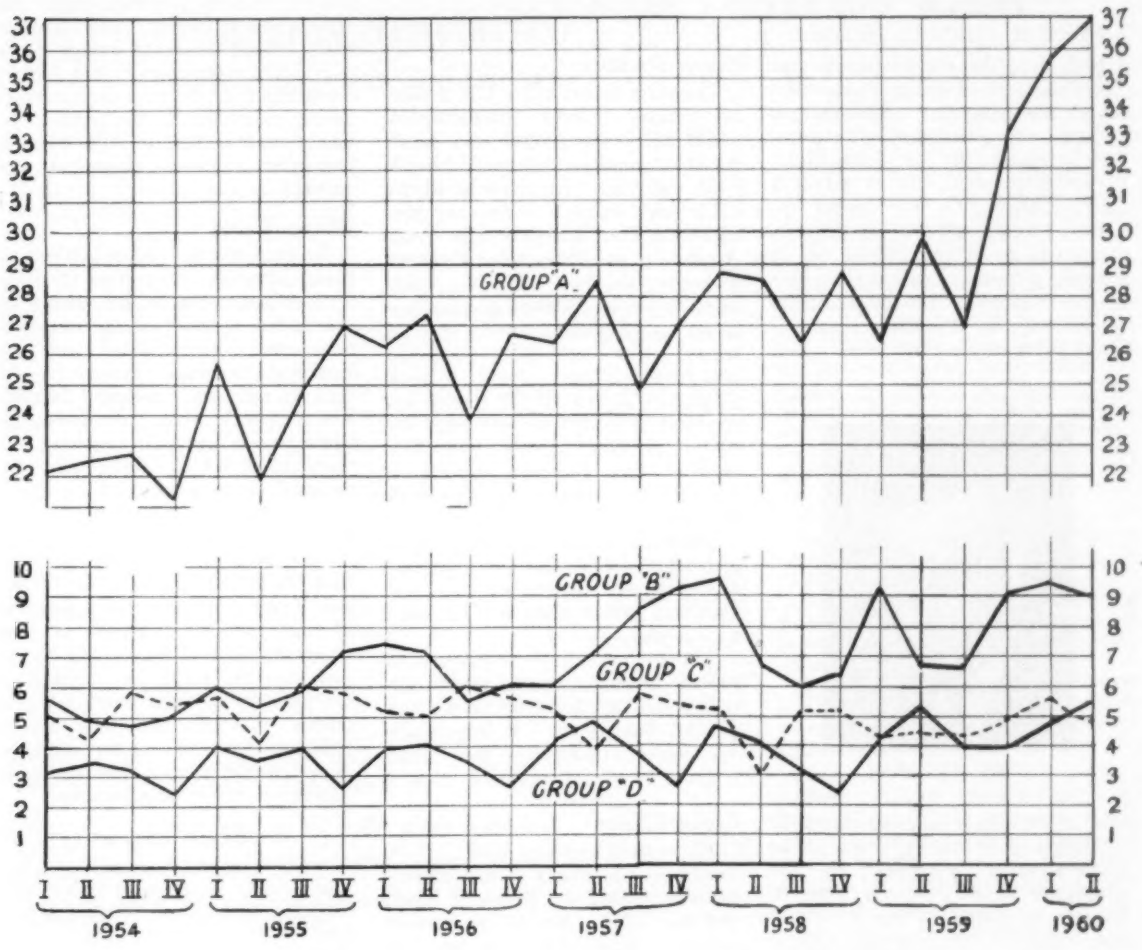
(b) Tyres and Tubes

ALL COUNTRIES

(Figures in £1,000 Sterling)

	Year 1957	Year 1958	Year 1959	First 6 mths 1960
Outer Covers				
For aircraft	814.3	624.6	806.1	472.6
For motor-cycles and tricycles	434.7	434.3	498.6	284.6
For other motor vehicles:				
New giant	13,706.2	10,501.7	11,088.4	6,163.0
New tractor and dumper and earth mover	2,151.5	2,205.7	2,561.6	1,559.5
New other sorts	4,762.1	5,293.1	6,511.4	3,671.5
Reconditioned or used giant	111.0	91.8	70.7	39.7
Reconditioned or used other sorts	355.7	418.3	487.9	233.5
For cycles	1,526.9	1,700.0	1,436.8	808.2
Other sorts	226.3	170.0	168.6	106.4
Total	24,088.7	21,439.8	23,630.5	13,339.5

	Year 1957	Year 1958	Year 1959	First 6 mths 1960
Inner Tubes				
For aircraft	53.6	48.8	41.9	25.6
For motor-cycles and tricycles	77.0	80.0	94.8	56.3
For other motor vehicles:				
Giant	739.0	626.5	622.1	354.2
Tractor and dumper and earth mover vehicle	136.0	124.3	163.2	106.2
Other sorts	488.5	528.9	516.9	333.7
For cycles	403.7	557.8	433.7	261.4
Other sorts	22.1	19.0	32.3	15.9
Total	1,919.9	1,985.6	1,905.3	1,153.8
Cushion and solid tyres	70.7	61.3	62.2	39.9
Camelback and other tyre repair materials	714.1	719.6	784.4	387.1
Grand Total	26,793.4	24,296.4	26,382.6	14,920.4



Graph showing UK exports (by value) of rubber products other than tyres and tubes, by quarters 1954, 1955, 1956, 1957, 1958, 1959 and January to June 1960

Contents of Groups 'A' (Rubber Manufactures), 'B' (Belting), 'C' (Footwear) and 'D' (Toys and Balls) are given in detail on page 642. Figures on the vertical scale represent £100,000.

COMMENTS ON THE EXPORT GRAPH

Total exports of general rubber goods (excluding tyres and tubes) continue to show an increase on previous years. The total figures at the end of the year showed an increase of nearly three-quarters of a million pounds, a considerable achievement, and the figures for the first half of 1960 show a satisfactory lead over the same period of 1959.

Group 'A' — Rubber Manufactures

Exports in Group 'A,' during the third quarter of 1959, lagged behind the second quarter but picked up markedly in the last quarter and have continued to rise through the first two quarters of 1960.

Group 'B' — Belting

Export sales of belting in the third quarter of last year stood level with the second quarter but rose again sharply in the last quarter of the old year and the first quarter of the new year. They have remained only slightly below the peak in the second quarter of 1960.

Group 'C' — Footwear

Exports of footwear, in the third quarter of 1959, dropped below the figures for the second quarter of the year but recovered steadily in the last quarter of 1959 and the first quarter of 1960. In the second quarter of 1960, although lower than the two previous quarters, the figures stand well above any of the first three quarters of 1959.

Group 'D' — Toys and Balls

Group 'D' exports which had reached a peak at this time last year declined in the last two quarters of 1959. They started to rise again at the beginning of 1960 and reached an unprecedented peak in the second quarter of this year.

FBRAM AND EXPORT PROMOTION

ONE of the functions of the Federation of British Rubber and Allied Manufacturers (FBRAM) is to assist the promotion of exports. The purposes of the Federation's Export Department are to act as a clearing house, for the rubber industry, for all items of information which can be of commercial use or interest; to produce statistical records of the industry's overseas trade; to record imports of rubber manufactured goods from abroad; to represent the industry's views and interests to Government departments at home, to the Federation of British Industries, or to official bodies overseas; and generally to assist rubber manufacturers in the export field.

THE AUTHOR

R. CHETWYND, M.B.E., M.A., is head of the Export Department of the Federation of British Rubber and Allied Manufacturers, responsible for the compilation of the foregoing statistics. He took his degree, history, at Oxford and served in the Grenadier Guards during the war. Before joining the Federation in June 1958, *he was in the Adjutant General's Department of the War Office.*

Export Information

The Department publishes a weekly Export Information Sheet which provides up-to-date information about changes in Customs Tariffs, Import Regulations, Import Quotas and other technical matters. Published with this are any confidential documents issued by the Board of Trade as well as a list of enquiries for business, or agency enquiries, forwarded by the Board of Trade or received by the Federation direct. Comparative tables for exports are included monthly and half-yearly.

Export Statistics

Complete statistics for UK exports of general rubber manufactures, world wide, are printed and distributed to members of the Federation every half-year. As a special service the figures relating to the Common Market and the European Free Trade Association are extracted and issued quarterly so that trends in these markets can be followed as closely as possible. Complete statistics of USA exports of general rubber goods are also produced once a year. Special summaries are issued for certain key products in both UK and USA exports. Annual figures for West German and Japanese exports of general rubber goods are also made available.

Statistics of UK exports of tyres and tubes, world wide, are prepared and published quarterly. USA and Canadian tyre exports are published once a year.

Although the field of imports of rubber manufactures is much narrower, statistics are kept for the current headings of the UK Import List and import trends are kept under review.

Export Liaison

A constant two-way traffic of information and views passes between the Federation, the Board of Trade and the FBI. Among the subjects currently dealt with have been the negotiation of the EFTA convention, the GATT tariff negotiations, various applications for protective duties made to Commonwealth and USA Tariff Boards, and bilateral trade negotiations with foreign countries. On these matters the Export Department forms a channel through which the views of the rubber industry, as formulated by the Federation's Overseas Trade Committee, can be expressed.

EEC and EFTA

By far the most important subject being considered by the Overseas Trade Committee is the impact on the rubber industry of the establishment and operation of the two European economic groups of the EFTA and the Common Market. Simultaneously a new round of negotiations is taking place between the members of GATT to determine the eventual common tariff of the Common Market and to promote further general reductions of tariffs. It will be the duty of the Export Department to keep members of the Overseas Trade Committee, and members of the industry, advised of new developments and trends, and to ensure that the views and interests of the industry in these fields are promoted. To this end some special publicity for the rubber industry, aimed specifically at the European Market, is under consideration.

Rubber Markets

Rubber market reports, London, New York, Singapore, Amsterdam, Djakarta, Bangkok and Colombo, have been omitted from this issue which closed for press earlier than usual. Reports and prices will appear next week.

Cobalt 60 radioactive industrial isotopes have been delivered to the Fawley, Hampshire, factory of Monsanto Chemicals Ltd. from the United Kingdom Atomic Energy Authority. Gamma rays from the isotopes will be used at the factory to determine the level of material in a very thick sealed vessel in the polythene plant. Here, Monsanto technicians lower the isotopes into a 4ft. deep concrete-lined storage pit

Plastics Statistics

AUGUST EXPORTS AND IMPORTS

EXPORTS of plastics materials for August registered a drop over the August 1959 figure. 12,323 tons were exported, compared with 12,853 tons. The values were £3,043,610 and £3,225,161. These figures are given in the official Trade and Navigation accounts, which show that the biggest quantity was taken by Australia (947 tons) followed by New Zealand (929 tons), South Africa (698 tons) and Western Germany (621 tons).

Imports during the month were 8,815 tons valued at £2,783,542 — double that of the same month in 1959 (3,840 tons; £1,450,073). USA was the major supplier with 4,103 tons. Then came Western Germany (1,721 tons) and Canada (560 tons). Imports for the first eight months of the year now stand at 63,903 tons (£20,218,379) — 1959 figures 33,691 (£12,456,375).

Exports for the first eight months stood at 114,612 tons (£29,157,104) as against 100,211 tons (£25,330,488.)

Details of imports of plastics materials during August, 1960:

	Tons	£
Alkyd solid and liquid resins, solutions, emulsions and dispersions	237	47,466
Cellulose plastics:		
Photographic (including cinematograph) film base (except acetate butyrate)	127	165,940
All other	359	286,938
Polyvinyl chloride:		
Polymers and copolymers	3,571	529,219
All other	531	194,564
All other	3,990	1,559,415
Total	8,815	2,783,542

Exports of plastics materials during August, 1960:

	Tons	£
Acrylic sheet, rod, tube, film, foil and profile shapes in primary form	586	344,399
Alkyd solid and liquid resins, solutions, emulsions and dispersions	441	102,073
Aminoplastics:		
Solid and liquid resins, including solutions	816	107,474
Moulding and extrusion compounds	604	105,460
Cellulose plastics:		
Moulding and extrusion compounds	248	78,033
Sheet, rod, tube, film (excluding regenerated cellulose), foil and profile shapes in primary form	122	75,985
Phenolics and cresylics:		
Solid and liquid resins (straight and modified)	768	140,184
Other	468	177,056
Polystyrene	845	179,245
Polythene (polyethylene) sheet, rod, tube, film, foil and profile shapes in primary form	179	75,110
Polyvinyl chloride:		
Polymers and copolymers	1,316	189,083
Moulding and extrusion compounds	767	180,925
Sheet	548	230,574
Other	133	31,364
All other	3,691	947,561
Waste and scrap (including celluloid and film waste and scrap)	783	79,084
Total	12,323	3,043,610

UK exports to countries in the European Economic Community (Common Market) and the European Free Trade Association are shown below.

EXPORTS TO EEC

	August 1959	August 1960
Western Germany	420	621
Netherlands	379	404
Belgium	300	443
France	292	366
Italy	343	606
	1,734	2,440

Exports to Commonwealth countries during the month were 4,874 tons (4,417 in August, 1959) and exports to all other foreign countries were 3,164 tons (4,557 tons).

EXPORTS TO EFTA

	August 1959	August 1960
Sweden	646	506
Norway	344	318
Denmark	515	387
Switzerland	242	267
Portugal	277	268
Austria	121	99
	2,145	1,845

Rubber Statistics

UNITED STATES — MALAYA

WITH most rubber plants back in production after July shutdowns for holidays, consumption of new rubber in USA for August increased to 125,409 long tons, compared with the 114,642 long tons consumed during the previous month, according to the monthly report of the US Rubber Manufacturers Association.

Consumption of all types of synthetic rubber in August amounted to 88,088 long tons, as compared with July's consumption of 79,413 long tons. The ratio of synthetic rubber to total new rubber consumption increased to 70.24% for August, surpassing the previous high ratio of 69.27% reached last month. The ratio for the first eight months of 1960 was 68.40% as compared with 65.44% for the same period in 1959.

Natural rubber consumption for August came to 37,321 long tons, as compared with the July figure of 35,229 long tons.

Production of synthetic during August was 121,809 long tons, as compared with the 116,584 long tons produced in July.

Reclaimed consumption for August was estimated at 21,385 long tons, as compared with the July figure of 19,249 long tons.

Malaya

Preliminary information has been given of Malaya's ocean shipments for the month of August (*RJIP* Oct. 1, 512). A breakdown of these shipments is:

Ocean shipments to:	Sheet and Crepe	Latex
UK	9,256	3,043
South Africa	966	95
Canada	1,468	—
India	2,570	8
Australia	2,782	539
Czechoslovakia	4,365	190
France	3,837	371
West Germany	5,467	1,055
Italy	3,566	204
Netherlands	1,141	435
Poland	4,747	690
Spain	1,465	80
Russia	7,110	—
USA	7,615	936
Argentine	1,965	156
Japan	6,496	1,116
Others	9,643	1,053
	74,459	9,773

Total sheet and latex 84,232 tons.

The total ocean shipments for the first six months of this year now stand at 712,764 tons.

The International Rubber Study Group, in the September issue of its Rubber Statistical Bulletin, has revised two figures originally given in its report for June. The end of month stocks in producing areas is now given as 260,000 long tons, and Indonesia's exports as 47,236 long tons.

Industry INTELLIGENCE

Technical Data

Surface Coating Resins

A pamphlet on synthetic resins for surface coatings recently published provides a list of the synthetic resins and allied products marketed by the Dyestuffs Division of I.C.I. Ltd. for this application.

Information on type of resin, solid content, acid value, viscosity, melting point, density and suggested uses is given in one set of tables and solubility and compatibility data are collected together in a second section.

The compatibility data are based on the production of a clear, homogeneous film on drying. Only simple mixtures of the resin and other materials have been considered and the addition of a third material such as a plasticizer or other resin may have a considerable modifying effect on the compatibility characteristics.

Different methods of determining the physical characteristics can give widely differing results and the methods used are described in an appendix to the pamphlet, although it is emphasized that even using the same method variations in technique can also have an effect on the results.

Vinyl Products

Information on the synthetic resin products of Vinyl Products Ltd., Carshalton, Surrey, is presented in a recently published leaflet. The company specializes in emulsions and solutions of vinyl resins but also produces methacrylate and styrene polymers and copolymers.

The resins are supplied in three forms, as water-based emulsions, solutions in organic solvents, and aqueous solutions under the trade names Vinamul, Vinalac and Vinapol respectively. These materials combine the characteristics of vinyl resins such as resistance to sunlight, oxidation and chemicals, with good film-forming and adhesive properties. They are used in a wide range of applications including emulsion paints and other decorative and protective finishes, textile and paper sizes and finishes, leather finishes and impregnants, adhesives, polishes, 'permanent' starches and, because they are non-toxic, odourless and tasteless, for toilet preparations.

Polastor Resins

Polyester resins are now being produced at their West Drayton works by Astor Boisselier and Lawrence Ltd., and are marketed under the trade name of Polastor. Information on these materials is given in technical bulletins available from the Sales Department, 9 Savoy Street, Strand, London, W.C.2.

Polastors 4 and 5 are primarily designed for glass-fibre lay-up work and the following properties are claimed to be particularly good. Shrinkage, low water absorption, strength of the cured resins and laminated resins and adhesion to metals. Polastor 4 is a flexible material and contains no additional plasticizer while Polastor 5 produces very stiff structures, bonds well to glass and has exceptional wetting out properties. For intermediate flexibilities, blends of the two resins give satisfactory results. Normal catalyst systems may be used but the use of benzoyl peroxide pastes is not entirely satisfactory and MEKP with cobalt naphthenate is the recommended system.

Machines, Materials and Equipment

Welding 'Difficult' Plastics

The range of Maxinec high frequency welding machines, made by Parnall and Sons Ltd., Lodge Causeway, Fishponds, Bristol, can now be supplied with new re-designed generators which are capable of welding such difficult materials as Polyflex (biaxially oriented polystyrene) cellulose acetate, various types of nylon as well as the normal PVC materials.

Regarding Polyflex, the company state that it has been confirmed to them that up to now no one in this country has succeeded in welding this material other than themselves, possibly due to its extremely low power factor. Their success should prove of interest in packaging in general for sealing vacuum formed packages. Machines available at Bristol for experimental purposes.

Bin Level Indicator

A range of bin level indicators, simple and robust in construction, are now being produced by Magco Ltd., Lake Works, Porchester, England. There are a minimum of parts; a plain main casing on the front of which is mounted a flexible diaphragm, the movement of which, by means of a push rod, operates a microswitch contained within the case and the employment of which gives a maximum sensitivity and allows the indicator to be installed at an angle, when required, without internal adjustment.

The indicator, or switch, can be used singly to indicate a specific level and, according to requirements, will operate either a visual or audible warning or both. When used in tandem, it can be made to give automatic control of a filling cycle. When the level in the container falls below the lower 'switch' it will automatically start the 'filler-motor' which will continue to operate until the level reaches the top 'switch' which will then automatically stop the 'filler-motor.' The two 'switches' may be mounted either inches or feet apart, according to the application. It can be used to indicate blockage in screw conveyors, elevators and chutes or to prevent damage to goods or conveyors from choking or jamming by the stopping of prior conveyors or feed units. Standard models cost £7 upwards.

Publications

Titanium Dioxide Pigments

A booklet recently published by British Titan Products Co. Ltd., is on the effect of weathering conditions on the gloss retention of an alkyd paint pigmented with rutile titanium dioxide. This is reproduced by permission of the Journal of the Oil and Colour Chemists Association.

A large number of identical alkyd gloss paints were exposed to natural weathering at different times of the year and regularly examined for gloss retention. The results have been analysed and related to the weather conditions prevailing during the test.

The degree of gloss failure has been shown to be closely related to the amount of solar energy falling on the surface, total energy greater than a fixed threshold value being most closely related to the rate of deterioration. It has not been possible to show any relationship between the wet time of paint films and loss of gloss. This lack of dependence upon measured wet time may be due to the periods of high relative humidity recorded at the test site.

RF Heating

The principle of radio-frequency or dielectric heating has been used for the curing of thermo-setting moulding powders, for welding sheet plastics and for many textile, foundry and food production applications. One of the most successful single applications, however, is for the setting of synthetic resin adhesives in the woodworking industries. Technical Notes 213 recently issued by Ciba (ARL) Ltd., Duxford, is the first half of a two-part article of the general principles and methods used in dielectric heating. Glue-line heating, through heating and stray-field heating are all discussed, and some details are also given on feeders and generators. The second part of the article will be published in the next issue of Ciba technical notes.

Patent Specifications

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Gas-expanded Cellular Articles

No. 847,081. Union Carbide Corporation. Application and Filed, October 12 1956. Application in USA, October 14 1955. Published, September 7 1960.

A blowing agent for rubber and plastics comprises a finely divided crystalline zeolite saturated with a gas desorbable at or just below the curing temperature of the material to be expanded. The blowing agent is mixed with the rubber or plastic in the usual way and on heating the mixture to the curing temperature, the adsorbed gas is released and builds up a cellular structure within the material. In examples, sodium zeolite saturated with water was used as the blowing agent for (a) SBR and (b) silicone resin, while sodium zeolite saturated with carbon dioxide was used as the blowing for silicone rubber.

Permanently-lubricated Rubber Bearings

No. 847,171. Clevite Harris Products Inc. Application and Filed, June 9 1958. Application in USA, June 11 and November 27 1957. Published, September 7 1960.

In a bearing assembly of the kind in which a rubber unit is positioned between two rigid elements for attachment respectively to two members to be connected by the bearing assembly, a lubricant is located between one or both of the rubber surfaces and the surfaces of the adjacent rigid elements. Escape of the lubricant is prevented preferably by forming a recess in the lubricated surface of the rubber unit.

Suitable lubricants when the rubber unit is of natural rubber or SBR include silicone oils, Carbowax (polythene glycol) and Ucon 50 HB (a polyalkylene glycol or a derivative thereof), while castor oil may also be used with natural rubber. The lubricated rubber bearings are particularly applicable for use in chassis linkages of motor vehicles.

Shorter Abstracts

Cord-to-rubber Bonding. 844,795. Goodyear Tire and Rubber Co. Filed, October 16 1957.—An adhesive formed from reaction of a mixture of vulcanizable rubber latex, a phenol and an aldehyde and a dithiocarbamate accelerator.

Pressure Sensitive Adhesive Webs. 845,052. Adhesive Tapes Ltd. Filed, April 22 1959.—Use of graft rubber polymers in the formation of key coats particularly on PVC base webs.

Seam Welding Thermoplastics. 845,381. Radio Heaters Ltd. Filed, January 13 1959.—HF dielectric heat welding of a thermoplastic sheet using a special jig to produce a hem weld.

PATENT LIST

Printed copies of the Specifications in the following list, published by permission of the Controller of H.M. Stationery Office, can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection August 24 1960

E. I. Du Pont De Nemours and Co. Manufacture of monovinylacetylene. 846,155.

Vereinigte Glanzstoff-Fabriken A.G. Process for the production of fine threads from aliphatic polyolefines of high molecular weight. 845,374.

Radio Heaters Ltd. Seam-welding of thermoplastic sheet material. 845,381.

Switzer Bros. Inc. Thermoplastic resinous materials and pigments made therefrom. 845,462.

Chemische Werke Albert. Synthetic polyiminocarbonate resins. 845,650.

Imperial Chemical Industries Ltd. Rendering fibrous materials water-repellent. 845,651.

P. Beiersdorf and Co. A.G. Process for the preparation of polycarbonates. 846,044.

Owens-Corning Fibreglas Corporation. Fibrous glass and fibrous glass fabric. 845,681.

General Tyre and Rubber Co. Weather and age resistant polyurethane compositions. 846,176.

Imperial Chemical Industries Ltd. Ethylene polymerization. 845,683.

Vereinigte Glanzstoff-Fabriken A.G. Method of treating polyethylene glycol terephthalate filaments or fibres in order to facilitate subsequent processing of the filaments or fibres, for example on a card. 845,688.

E. I. Du Pont De Nemours and Co. Grafting of polymers to cellulose substrates. 845,690.

F. Hoffman-Le Roche and Co. A.G. Novel polyene compounds and the manufacture and conversion thereof. 845,819.

Chemische Werke Albert. Production of new resinous condensation products. 845,494.

T. Goldschmidt A.G. Method of producing suitable continuous paper, textile and like fabric sheets impregnated with amino-plast resins for use as surfacing materials. 845,821.

Union Carbide Corporation. Acceleration of the reactions of organic compounds. 845,827.

Dow Chemical Co. Method of sealing vinylidene chloride polymer surfaces to one another. 845,626.

Byk-Gulden Lomberg, Chemische Fabrik G.m.b.H. Process for welding thermoplastic polymeric material. 845,630.

J. F. Campbell. Apparatus for vulcanizing V-belts and other endless articles. 846,074.

E. I. Du Pont De Nemours and Co. Production of films and other shaped structures of polyvinylfluoride and polyvinylidene fluoride. 845,634.

General Mills Inc. Polyamide resins. 845,560.

Rohm and Haas Co. Solid thermoplastic compositions. 845,638.

Engelhard Industries Inc. Purification of ethylene. 846,077.

Esso Research and Engineering Co. Deashing polymers with alpha diketones. 845,851.

Ankerwerk Geb. Goller. Moulding of hollow bodies from thermoplastic substances. 845,852.

Rubber Improvement Ltd., and J. Lewis. Anti-static flooring or wall covering of plastic, rubber or synthetic elastomer. 845,871.

Rubber and Plastics Stock Market

Rubber and Plastics Stock Market Report and Prices, published on alternate weeks, will appear in next week's issue of *RJIP*. Plantation Share Survey, the monthly feature on the progress of rubber plantation companies, will appear in the issue for October 29.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

AVON

(798,978) Rollers made of rubber, artificial rubber or of plastics and being parts of machines. The Avon India Rubber Co. Ltd., 'Avon' India Rubber Works, Melksham, Wiltshire. (Class 7; September 28 1960).

NACRESTER (791,042) Polyester resin plastics in imitation of mother-of-pearl. Alti Polimeri Industria Chimica, via Montebello 27, Milan, Italy. Address for service is c/o Marks and Clerk, 57-58 Lincoln's Inn Fields, London, W.C.2. (Class 20; September 28 1960).

DRISEL (793,284) Sliding clasp closures formed principally of extruded plastics. E.P.S. Research and Development Ltd., Staplehurst Road, Sittingbourne, Kent. (Class 26; September 28 1960).

NEW COMPANIES

Piastechnique Ltd. (669,606).—September 8. Capital: £100 in £1 shares. To carry on the business of plastics engineering, etc. The directors are: Peter H. James, Andrewville Court, Cleveland Square, W.2.; Major Sharp, 102 Roding Road, Loughton. Regd. office: 102 Roding Road, Loughton.

Chemek Refiners Ltd. (669,346).—September 6. Capital: £5,000 in £1 shares. To carry on the business of manufacturers of and dealers in chemicals and plastics, drugs and other pharmaceutical preparations and equipment, electronic and nuclear apparatus and equipment and laboratory equipment, etc. The directors are: David S. Pryke, 115 Stradbroke Grove, Ilford; Michael S. Coomber, 19 North House, Bushfair, Harlow, Essex; Harry Hupston, 105 The Downs, Harlow. Regd. office: 50 Stoke Newington Church Street, N.16.

Easistamp Ltd. (669,443).—September 7. Capital: £5,000 in £1 shares. To carry on the business of manufacturers of rubber stamps of all kinds, embossing presses, etc. The directors are: Charles Ramsden, 53 Shirehall Park, Hendon, N.W.4; Herbert W. C. Lewell, 103 Cranley Gardens, N.10; Gordon T. Hills, 84 Chancery Lane, W.C.2 (directors of William Jones Clifton & Co. Ltd.). Regd. office: 68 Hanson Street, Marylebone, W.1.

Tec-Bones Ltd. (669,518).—September 7. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in articles used in the stiffening of articles of clothing and textile articles of all kinds, etc. The directors are: Mrs. Thoma M. Lawrence and Gerhard Kruse, both of 11 Berkeley Court, Vines Avenue, N.3. Regd. office: 6 Surrey Street, W.C.2.

D.M.D. (Fibreglass) Ltd. (669,492).—September 7. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in and workers of fibreglass, etc.

Carlton Plastics Ltd. (670,530).—September 21. Capital: £100 in £1 shares. To carry on the business of manufacturing, moulding, dealing in plastics, etc. The first directors are to be appointed by the subscribers. Regd. office: Parkstone Works, Wingletye Lane, Hornchurch.

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(continued)

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A VACANCY occurs for a young rubber technologist of L.I.R.I. standard. Experience in footwear compounds would be an advantage. This is an opening with good prospects.—Applications, which will be treated with confidence, should be addressed to:—Sam Kay Rubber Co. Ltd., Hope Mill, Portwood Place, Stockport. (542)

PRODUCTION MANAGER with technical experience required by long-established manufacturer to take complete charge of latex foam department. Applicants should be between 30/35 years of age and capable of maintaining output and quality at a high standard and prepared to work on their own initiative with minimum directions. The post is an attractive one for a man with enterprise and ability. Salary and conditions of employment will be commensurate with responsibility entailed.—Reply in first instance to Box 590. (590)

ENGINEERS

A new Division manufacturing industrial rubber products was formed recently by an old-established Company in the North. Continued expansion necessitates the recruitment of the following staff.

CHIEF DRAUGHTSMAN (age over 35)

A well-qualified designer is required to direct two small D.O. sections, each with a Senior Designer, and to be responsible to the Chief Engineer.

Applicants must have a good record of responsible design work in the rubber and plastics industry or in a similar field, and experience of standard rubber plant and factory services. Ingenuity combined with sound general engineering knowledge is required for the design of special-purpose machinery. H.N.C. in Mech.Eng. is a minimum standard.

The successful applicant will have an opportunity to apply his own ideas in building up a design unit. To attract the man who is already well paid, a substantial salary is offered.

SENIOR DESIGNER (age about 30)

A design draughtsman will be appointed as leader of a small D.O. section, at present being formed. Knowledge of rubber plant would be helpful but D.O. experience in general engineering is more important.

Preferably, the successful applicant will have gained H.N.C. and, although basically a mechanical engineer, have experience of all services.

ASSISTANT PROJECT ENGINEER (age 25 to 30)

An Engineer is required to assist in projects from initial investigation through design and pilot manufacture stages to the setting up of a new production unit.

Applicants should have H.N.C. (Mech. Eng.), five years' practical training and at least three years' D.O. experience in general engineering. Previous experience of plant layout, including services, particularly in the rubber industry, will be a considerable advantage.

ASSISTANT WORKS ENGINEER (age over 25)

H.N.C. (Mech. Eng.) would be an advantage but it is more important that the successful applicant has a sound general engineering background and the initiative to get things done, using the services of an Engineering Maintenance and Service Department. Knowledge of rubber plant would be useful.

These are progressive and permanent positions offering attractive salaries, with an annual review and bonus. Superannuation, housing and removal assistance is available.

Interviews can be held at weekends and outside office hours, if necessary in the area where applicants live. All applications will be acknowledged and treated in strict confidence. They should be addressed to Chief Engineer, Box 587. (587)

APPOINTMENTS VACANT

(continued)

EXPERIENCED operator required for battery separator plant with some knowledge of lamination of plastics. Factory is situated in Kings Cross area.—Write giving dates and positions previously held to Box R.P. 743, c/o Hanway House, Clark's Place, E.C.2. (583)

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A senior chemist/technologist (age 35 to 45) is required as deputy department head to assist in managing the activities of the Development Department of a rapidly expanding factory producing hose, belting and general mechanicals. Applicants should possess wide experience in compounding natural and synthetic rubbers and PVC coupled with a theoretical and practical knowledge of rubber and plastics technology and chemistry. It is also desirable, but not essential, that applicants possess practical experience in the manufacture of the aforementioned products. The initial salary will be in the region of £2,000 and the position offers early prospects of advancement. It is expected that the successful applicant will be capable of assuming full control of the Department in the future and it is essential therefore that applicants have held a responsible position in the industry for several years. During this time they should have gained administrative as well as technical experience. The Company is a member of a group of National repute, offering excellent terms of employment. Details of pension, housing and removal assistance, etc., will be given to selected applicants.—Further details of the appointment may be obtained by applicants who address brief details of their carer to Group Personnel Manager, Box 586. (586)

WAR Office requires chemist at Didcot, Berks., to lead section concerned with design and development of clothing and general stores items involving leather, plastics and rubber. Qualifications: honorary degrees in chemistry or physics, A.R.I.C. or A.Inst.P. or equivalent. Industrial or research and development experience in high polymers or leather technology. Knowledge of boot and shoe industry an advantage. Salary: £1,245—£1,680. Unestablished but opportunities to compete for establishment. Excellent prospects.—Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting reference F.715/OA. Closing date November 30, 1960. (575)

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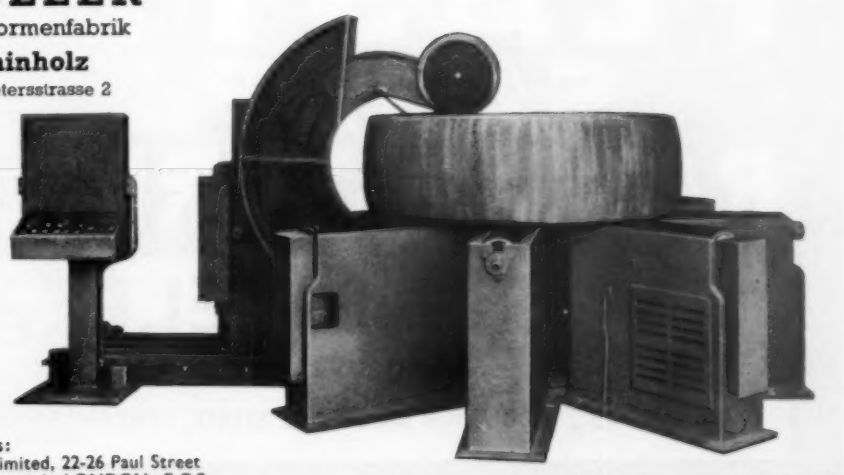

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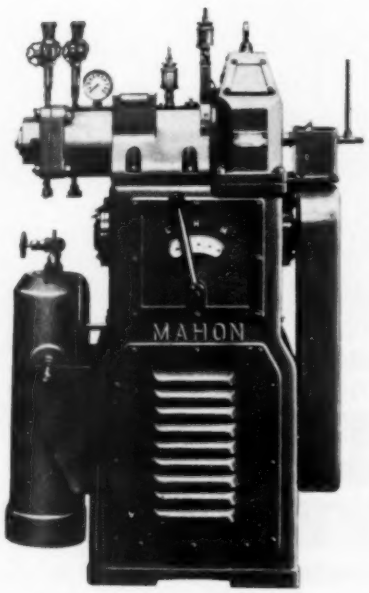

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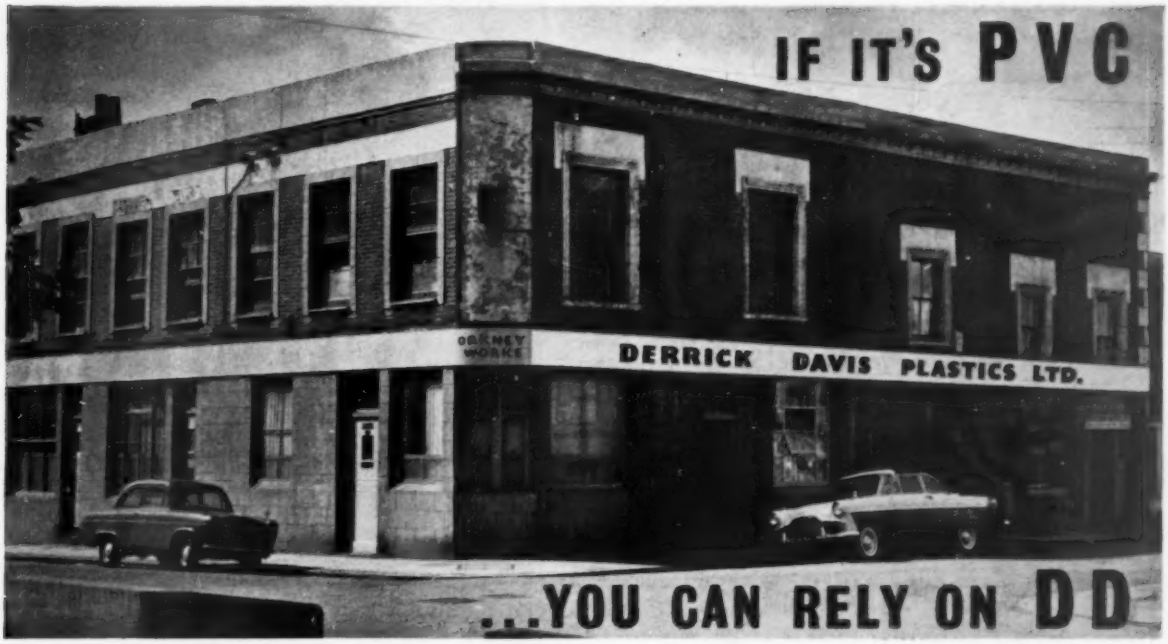

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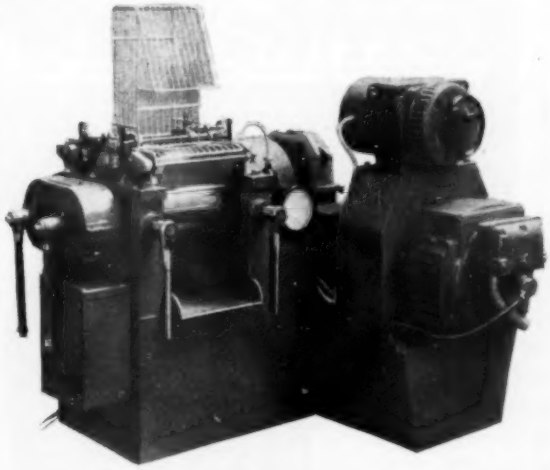

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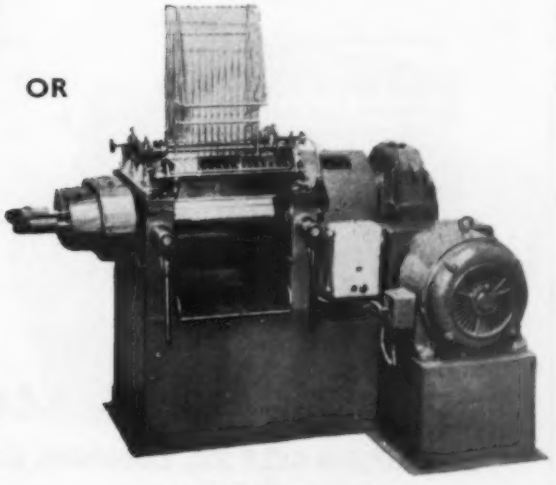

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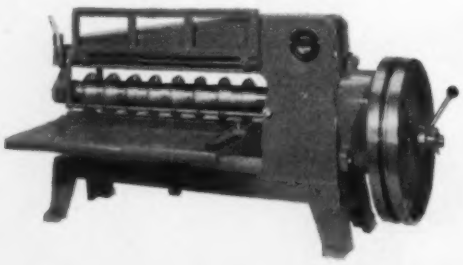

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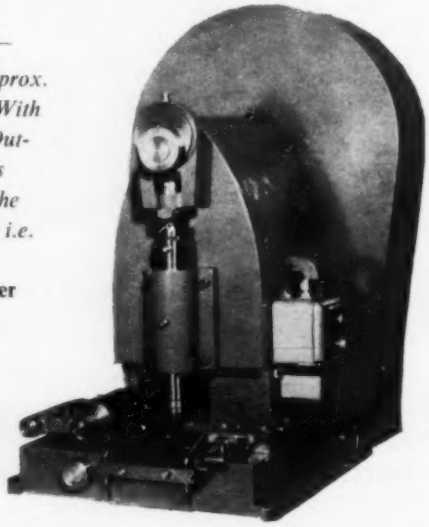

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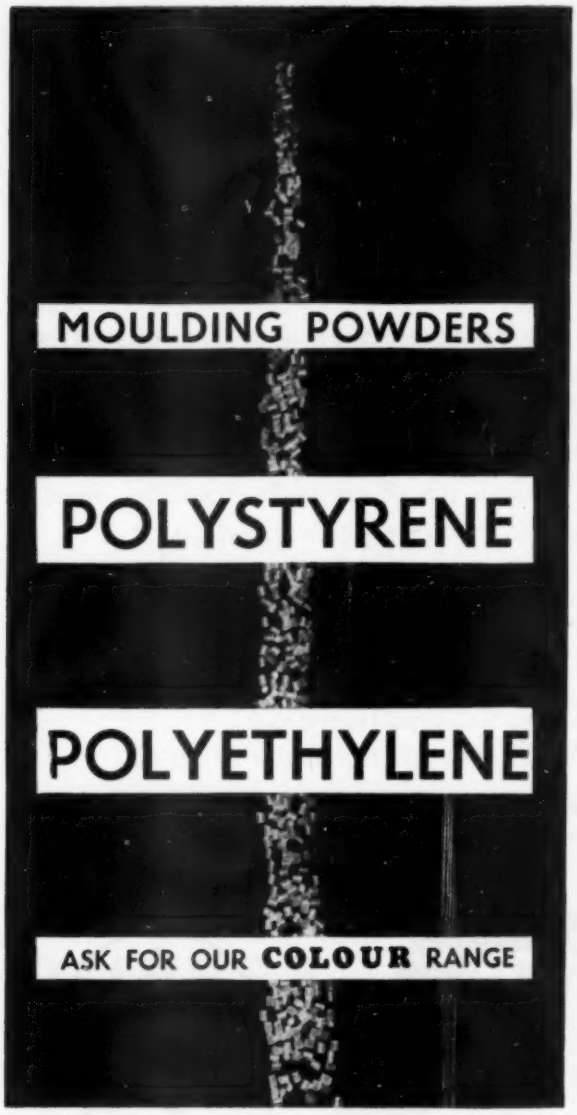

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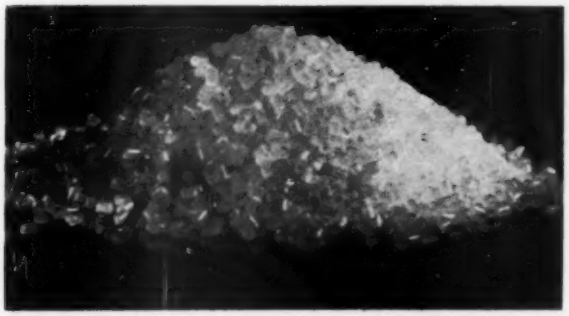

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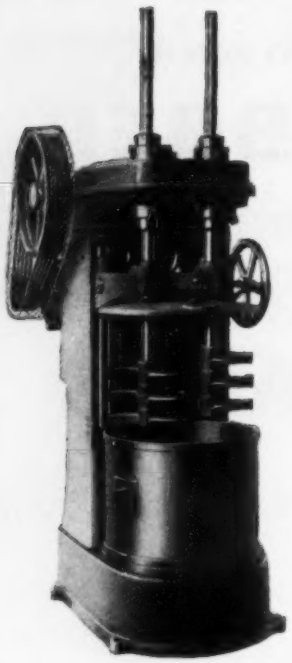

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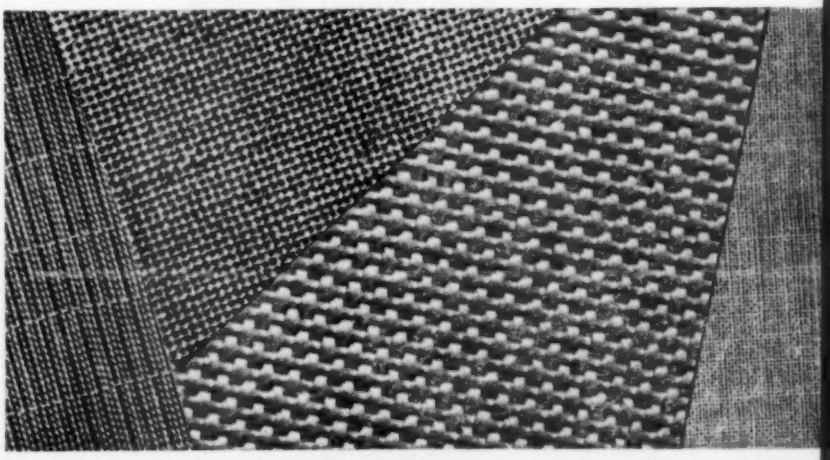

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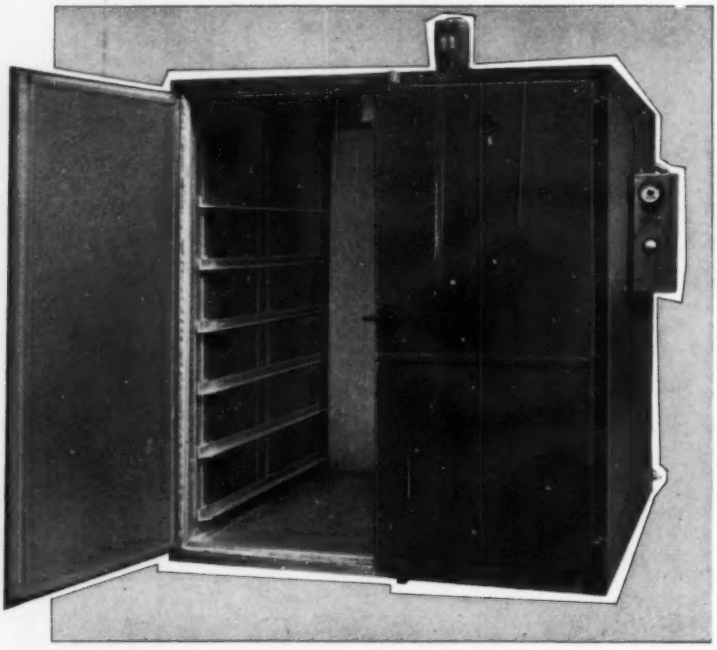

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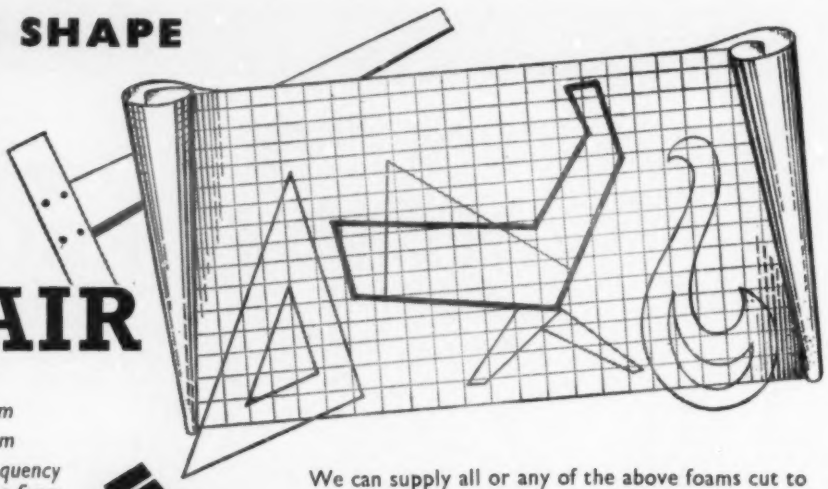

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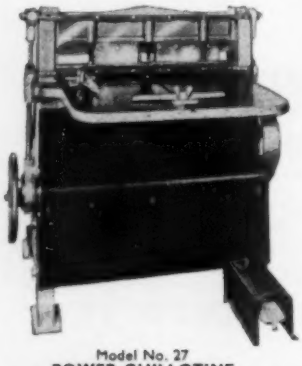

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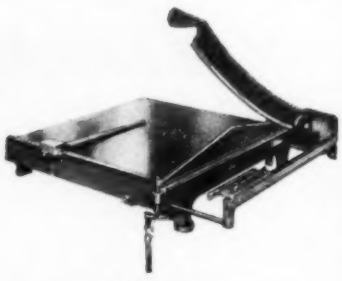

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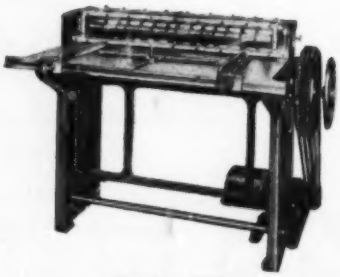

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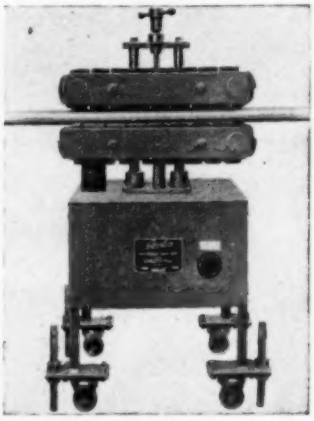

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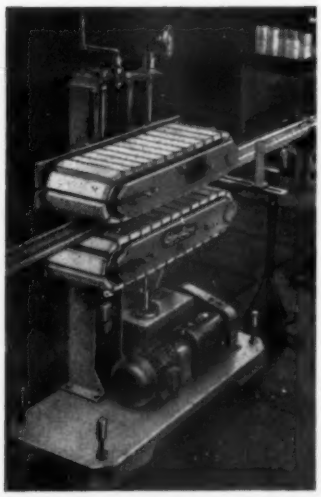

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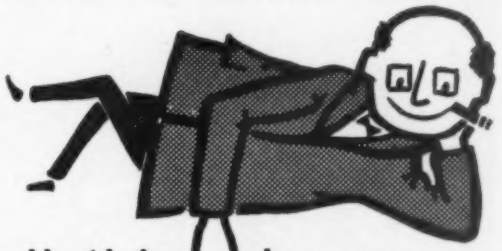

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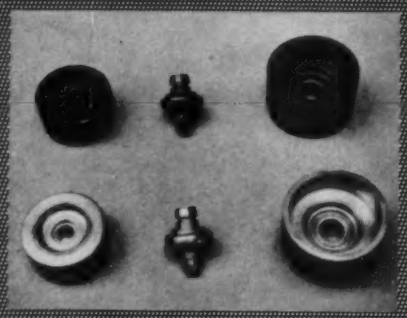

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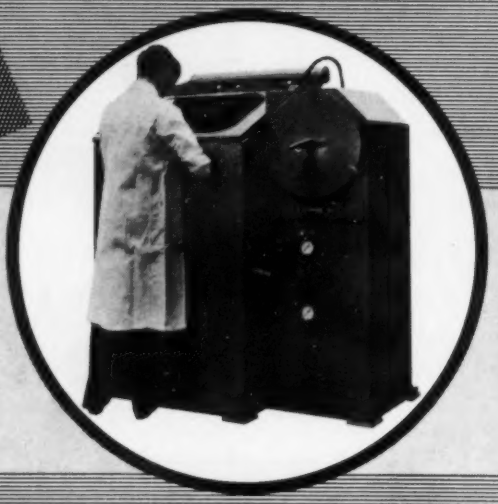

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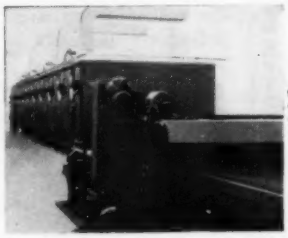

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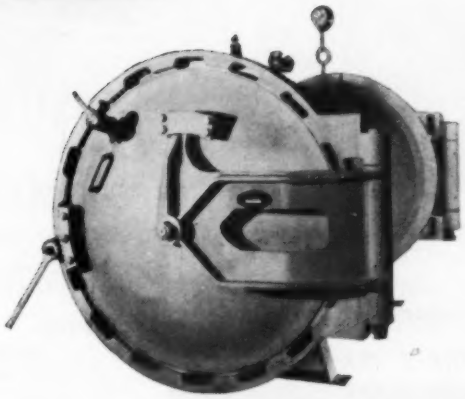

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TROESTER, whose headquarters are at Hanover, supply standard rubber processing equipment — including mills, calenders and extruders. Their complete range has been redesigned recently to meet the present day trend towards higher output.

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